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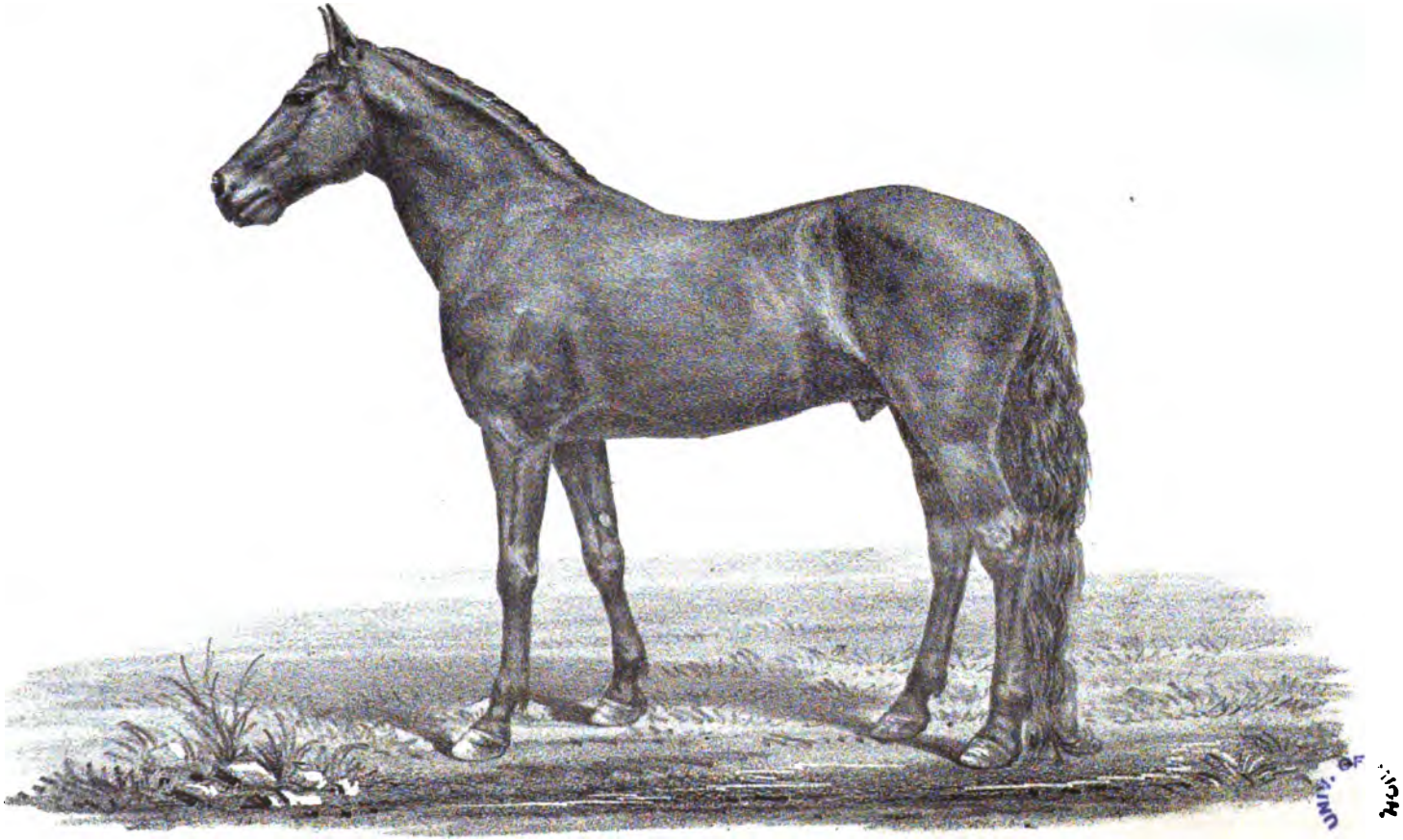


THOMAS JEFFERSON.

International Exhibition - Live Stock, Philadelphia, 1876.

REPORT

OF THE

TRANSACTIONS

OF THE

PENNSYLVANIA STATE AGRICULTURAL SOCIETY,

FOR THE YEAR 1876.

VOLUME XI.

HARRISBURG,

B. F. MEYERS, STATE PRINTER.

1876.

TO THE READER.

This is the eleventh volume of the series of publications designed as part of its work, by the founders of the Pennsylvania State Agricultural Society. Its contents and illustrations will compare favorably with its predecessors, and be found of use to those into whose hands it may fall.

The Executive Committee having in view the success of the great Centennial International Exhibition at Philadelphia, after considering the subject of holding an exhibition of this Society during the fall of 1876, decided that it was proper to postpone such action, so that the people should not be diverted from a much more attractive and instructive exhibition than our Society with its limited resources, could hope to present. The success which has attended the great exhibition is very gratifying to the Pennsylvania Society.

The Executive Committee voted one thousand dollars to the Centennial Commission, to be awarded under its direction. It is hoped that a full report of the disposition of this donation will be made before this volume passes through the press.

The proceedings of the Society and Executive Committee are given, completing the official record.

164988

CONSTITUTION AND LIFE MEMBERS

OF THE

PENNSYLVANIA STATE AGRICULTURAL SOCIETY,

The Pennsylvania State Agricultural Society was created "a body corporate" by the Legislature, on the 29th day of March, 1851. The act at large can be found in the statutes for 1851, and in previous volumes of the transactions of this Society. The Society sprung from a meeting held at Harrisburg, on the 21st of January, 1851, in which all the counties of the State were represented. On the 22d the meeting had taken the form of a society, electing its first president and officers. On the 20th of January, 1852, it held its first annual meeting at Harrisburg, where, in the previous September, its first exhibition had been held, with a good degree of encouragement. Exhibitions have since been held at Lancaster, Pittsburg, Philadelphia, Harrisburg, Wyoming, Norristown, Williamsport, Easton, Scranton and Erie, with varying success, but always doing something toward developing the agricultural resources of the State.

The concerns of the Society are entrusted to an Executive Committee, consisting of a president, twenty-seven vice presidents, one from each of the Congressional districts into which the State is divided, five additional members, all the ex-presidents, a corresponding and a recording secretary, a treasurer, a chemist and geologist, and a librarian, in all, as at present constituted, a committee of forty-five.

The constitution has been frequently, but not substantially, amended since its original adoption in 1852, and now stands as it is given herewith. A list of life members is embodied in this issue. It has been impossible to preserve a necrological register, and therefore lapses by death are not noted. The list comprises the names of all life members previously to the first January, 1876; a total of 821 names, representing all parts of the State.

CONSTITUTION OF THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY.

The name of the Society shall be THE PENNSYLVANIA STATE AGRICULTURAL SOCIETY. The objects of this Society are to foster and improve agriculture, horticulture and the domestic and household arts.

WHO ARE MEMBERS.

SECTION 1. The Society shall consist of all such persons as shall pay to the Treasurer not less than two dollars, and annually thereafter not less than two dollars; and also of honorary and corresponding members; the names of the members to be recorded by the Secretary.

The officers of county agricultural societies in this State, or delegations therefrom, shall be members *ex officio* of this Society.

The payment of twenty dollars shall constitute life membership, and exempt the members so contributing from all annual payments.

OFFICERS.

SECTION 2. The officers of the Society shall be a President, a Vice President from each Congressional district, three-fourths of whom shall be practical agriculturists, or horticulturists, a Treasurer, a Corresponding Secretary, a Recording Secretary, a Librarian, an Agricultural Chemist and Geologist, and such assistants as the Society may find essential to the transaction of its business, an Executive Committee consisting of the above named officers, five additional members, with the ex-presidents of the Society.

OF THE PRESIDENT.

SECTION 3. The President shall have a general superintendence of all the affairs of the Society. In case of the death, illness or inability of the President to perform the duties of his office, the Executive Committee shall select a Vice President to act in his stead, who shall have the same power and perform the same duties as the President, until the next annual meeting.

OF THE VICE PRESIDENTS.

It shall be the duty of the Vice Presidents to take charge of the affairs of the association in their several districts; to advance all its objects; to call upon farmers to report as to the condition of agriculture in their neighborhood; to ask for information as to the modes of cultivation adopted by different farmers; and, as far as in their power, to make known the resources of their districts, the nature of its soil, its geological character and all such matter as may interest farmers in every part of the State.

TREASURER.

The Treasurer shall keep an account of all moneys paid into his hands, and shall pay bills when audited and approved by the Executive Committee; each order for payment must be signed by the President or chairman of the Executive Committee.

CORRESPONDING SECRETARY.

The duty of this officer shall be to invite a correspondence with all persons interested in agriculture, whether in the State of Pennsylvania or elsewhere, but especially with our consuls in foreign countries, that new seeds, vegetables or live stock may be introduced, and their fitness for cultivation and propagation in our climate be tested. At each stated meeting of the Society he shall read his correspondence, which shall, either the whole or such parts as may be selected by the Society form a portion of the transactions. He shall also correspond with the president or other officers of each State society in the United States, at least twice in the year, for purposes of combined and mutual action, and to be informed of the result and progress of each other's efforts; also, to invite mechanics to forward models or implements for examination and trial.

RECORDING SECRETARY.

The Recording Secretary shall keep the minutes of the Society and of the Executive Committee; at the close of each year he shall prepare for publication such parts of the minutes and transactions of the Society as may be designated.

LIBRARIAN.

The Librarian shall take charge of all books, pamphlets, &c., belonging to the Society, and shall act as curator to preserve seeds, implements or whatever property the Society may possess.

EXECUTIVE COMMITTEE AND QUORUM.

The Executive Committee shall transact the business of the Society generally, and shall appoint, annually, at their first quarterly meeting, a Recording Secretary and Treasurer, fix their salaries, and require security from the Treasurer, if they deem it necessary; shall superintend and direct the publication of such of the reports and transactions as they may deem proper, and shall designate the time and places for annual exhibitions, regulate the expenditures, examine all accounts, and keep such general charge of the affairs of the Society as may best promote its interests.

They shall select their own chairman, and meet quarterly, and at any other time when convened by the President; five members shall form a quorum.

They shall call special meetings of the Society when necessary.

ANNUAL MEETING OF THE SOCIETY AND QUORUM.

SECTION 4. The Society shall meet annually, on the third Wednesday of January, at Harrisburg, when all the officers of the Society, not otherwise appointed, shall be elected by ballot for the ensuing year, and until another election. They shall also hold a general meeting at the time of the annual exhibition, and special meetings whenever convoked by the Executive Committee.

Fifteen members shall form a quorum for the transaction of business, but no member in arrears shall be entitled to the privileges of the Society.

QUALIFICATIONS OF VOTERS.

SECTION 5. No annual member, hereafter, shall be entitled to vote for the election of officers of the Pennsylvania State Agricultural Society, unless he shall have been a member at the previous State fair, and in default of a State fair, then three months previous membership shall be necessary.

SECTION 6. No one shall be eligible to office hereafter who has not obtained a right to vote under section five.

ALTERATION.

SECTION 7. This Constitution may be altered or amended, at the annual meetings in January, by a vote of two-thirds of the members in attendance.

LIFE MEMBERS.

Austin, John B., Philadelphia.
Alibone, Thomas, Philadelphia.
Allen, Josiah J., Philadelphia.
Anspach, J., Jr., Philadelphia.
Armstrong, James, Williamsport.
Allen, Robert P., Williamsport.
Andrus, D. S., Williamsport.
Allen, Charles, Williamsport.
Armstrong, William H., Williamsport.
Allen, John H., Montoursville.
Ayers, J. J., Williamsport.
Andrews, E., Williamsport.
Allen, Wm. H., Agricultural College.
Armstrong, W. H., Easton.
Ashbridge, E. B., Willistown Inn P. O.
Allen, John E., Middletown.
Alricks, William K., Harrisburg.
Allen, John F., Harrisburg.
Anderson, James, Hogestown.
Bucher, G. H., Hogestown, Cumb. county.
Biddle, Craig, Philadelphia.
Boal, George, Boalsburg.
Bryson, Robert, Carlisle.
Baldwin, M. W., Philadelphia.
Brock, Wm. Penn, Philadelphia.
Biddle, Alexander, Philadelphia.
Brown, George H., Philadelphia.
Boldin, George, Philadelphia.
Bard, Edwin Milford, Philadelphia.
Baxter, Isaac B., Philadelphia.
Burnside, James, Bellefonte.
Benson, Alexander, Philadelphia.
Bonson, G. S., Philadelphia.
Bradford, Vincent L., Philadelphia.
Brown, John A., Philadelphia.
Billings, James B., Philadelphia.
Brown, David S., Philadelphia.
Baker, Elias, Altoona.
Brautigam, Daniel, Northumberland.
Brown, Jacob B., Columbia.
Bell, Samuel, Reading.
Bell, William, Mifflin.
Bennett, James, Pittsburg.
Beck, John B., Williamsport.
Bowman, Samuel, Wilkesbarre.
Breeze, N. W., Wyoming.
Barto, Tobias, Reading.
Bercaw, Abraham, Easton.
Berkenbine, Sam'l A., Northumberland.
Blair, Horace H., Williamsport.
Beard, Henry, Williamsport.
Beck, Samuel M., Williamsport.
Brown, James V., Williamsport.
Brown, Jacob, Newberry.
Berry, John J., Williamsport.
Bush, D. G., Bellefonte.
Butt, Charles H., Williamsport.
Bender, George H., Easton.
Blight, George, Germantown.
Boyd, T. S., Easton.
Brawdy, George, Sharpsburg.
Bergner, George, Harrisburg.
Bissel, William S., Pittsburg.
Bittenbender, Stephen, Shamokin.
Brown, G. W., M. D., Port Carbon.
Boyd, S. T., Easton.
Buehler, William, Harrisburg.
Boas, C. A., Harrisburg.
Bates, Abram, Harrisburg.
Bigler, Samuel S., Harrisburg.
Bomberger, Jacob C., Harrisburg.
Boyer, W. W., Harrisburg.
Briggs, John H., Harrisburg.
Boas, D. D., Harrisburg.
Bird, Joseph, Northumberland.
Buehler, Charles, Harrisburg.
Barr, Dr. W., Harrisburg.
Baily, Charles L., Pottstown.
Brown, James C., New Greenville.
Bound, David T., Kingston.
Baldwin, William A., Erie.
Branson, David H., Coatesville.
Cameron, Simon, Middletown.
Curwin, John, Harrisburg.
Chambers, Andrew R., Philadelphia.
Christian, S. J., Philadelphia.
Campbell, Hugh, Philadelphia.
Campbell, James R., Philadelphia.
Cadwallader, George, Philadelphia.
Colkit, C., Philadelphia.
Craig, Hugh, Philadelphia.
Carpenter, George W., Jr., Germantown.
Campbell, Thompson, San Francisco, Cal.
Cassiday, Joseph A., Philadelphia.
Clark, Edward S., Philadelphia.
Carmalt, S., Friendsville, Susquehannaco.
Cresson, John C., Philadelphia.
Carlisle, Robert M., Philadelphia.
Cornell, Adrian, Newtown, Bucks co.
Campbell, William S., Philadelphia.

Cowden, J. B., Northumberland.
Chess, Moses, Temperanceville.
Calder, William, Harrisburg.
Conyngham, John N., Wilkesbarre.
Carson, George N., Norristown.
Cake, Jos. W., Northumberland.
Calder, Rev. James, Harrisburg.
Clymer, Hiester, Reading.
Conner, Joseph P., Fowlersburg.
Crans, Samuel M., Williamsport.
Campbell, John R., Williamsport.
Clark, James, Williamsport.
Clay, M. L., Williamsport.
Coleman, Fletcher, Williamsport.
Canfield, Ezra, Williamsport.
Campbell, E. B., Jersey Shore.
Cummings, R. D., Bellefonte.
Claydon, William, Pine Grove.
Cramer, Jacob, Uniontown.
Carter, William N., Jersey Shore.
Coryell, John B., Williamsport.
Crawford, A. S., Williamsport.
Colton, Henry, Williamsport.
Coder, N. B., Williamsport.
Capron, E. W., Williamsport.
Calvin, Otis P., N. Y. City, No. 234 Broadway.
Carpenter, E. P., Pittsburg.
Cummings, A. B., Philadelphia.
Charles, J. S., Pittsburg.
Cluley, William, Pittsburg.
Coburn, J. P., Aaronsburg, Centre co.
Crawford, M. H., Philadelphia.
Child, S. S., Harrisburg.
Cummings, Charles, Harrisburg.
Colestock, Jacob M., Harrisburg.
Colestock, Samuel H., Harrisburg.
Cassel, Jacob, Harrisburg.
Criswell, J. Vance, Harrisburg.
Coover, John B., Mechanicsburg.
Cameron, J. D., Harrisburg.
Chrisman, R. R., Harrisburg.
Callahan, George, Philadelphia.
Connelly, John, Hyde Park.
Darlington, J. Lacy, West Chester.
Davis, Atlee G., Philadelphia.
Dettry, Henry F., Philadelphia.
Dickey, E. V., Oxford.
Derbyshire, A. J., Philadelphia.
Durar, Enoch, Philadelphia.
Dallett, John, Philadelphia.
Devereaux, John, Philadelphia.
Devereaux, James, Philadelphia.
Deal, Daniel, Philadelphia.
Dasher, David, Harrisburg.
Drinker, H., Montrose.
Driesbach, Daniel G., Beach Haven.
Davis, William L., Easton.
Dœbler, V. S., Williamsport.
Dunlap, H. E., Newberry.
Davis, John L., Newberry.
Du Bois, John, Williamsport.
Datesman, Robert, Milton.
De Haven, Jehu, Harrisburg.
Dempster, Robert, Phillipsburg, N. J.
Duncan, J. L., M. D., Pittsburg.
Demoes, John, Shamokin.
Darlington, H., Pittsburg.
Davis, Joseph H., Pittsburg.
Dull, J. J., Harrisburg.
Dougherty, James D., Harrisburg.
Dougherty, Daniel, Harrisburg.
Deitz, George A., Chambersburg.
Du Barry, J. N., Harrisburg.
Eli Richard E., Philadelphia.
Evans, David, Philadelphia.
Edwards, William A., Philadelphia.
Ellis, William, Philadelphia.
Evans, John, York.
Elwyn, A. L., Philadelphia.
Eby, Jacob R., Harrisburg.
Eichbaum, William, Pittsburg.
Eberly, Christian, Cumberland.
Everhart, J. T., Pittston.
Engle, Charles K., Bustleton.
Ellis, B. Morris, Hughesville.
Earley, Martin, Palmyra.
Eddy, George W., Philadelphia.
Ensworth, L. A., Williamsport.
Eves, George S., Williamsport.
Embick, Frederick E., Williamsport.
Eldred, Charles D., Williamsport.
Elder, Mathias, Williamsport.
Edwards, Charles, Williamsport.
Elliott, William G., Williamsport.
Eveland, S. D., Williamsport.
Evender, Thomas, Williamsport.
Epes, William J., Williamsport.
Elser, D. B., Williamsport.
Eckert, Isaac, Reading.
Eves, Andrew, Muncy.
Elder, James, (Swatara,) Harrisburg.
Elliott, B. A., Pittsburg.
Elliott, W. R., Pittsburg.
Estep, J. P., Pittsburg.
Etter, B. F., Harrisburg.
Emminger, John, Hoggestown.
Early, D. S., Hummelstown.
Egle, W. H., M. D., Harrisburg.
Ensminger, J. T., Harrisburg.
Emminger, W. H., Harrisburg.
Edwards, Oliver, Harrisburg.
Evans, Robert, Erie.
Fager, George C., Harrisburg.

Freas, P. R., Germantown.
Frantz, Jacob, Mount Hope, Lancaster co.
Fotterall, Stephen G., Philadelphia.
Foster, Frank T., Philadelphia.
Fales, George, Philadelphia.
Fallon, Chris'r, U. Darby, Delaware co.
Flenniken, J. C., Waynesburg, Greene co.
Felton, S. M., Philadelphia.
Fulton, Andrew, Pittsburg.
Firmstone, William, Easton.
Fleming, Robert, Williamsport.
Fessler, Philip, Williamsport.
Foresman, Robert M., Williamsport.
Fisher, John S., Williamsport.
Foresman, D. W., Williamsport.
Foresman, John, Williamsport.
Foresman, Daniel F., Slifer, Union co.
Foresman, R. S., Williamsport.
Fuller, J. W., Montoursville.
Farrel, John, Pittsburg.
Fass, G., Allegheny City.
Frisch, B., Harrisburg.
Fisler, J. E., Harrisburg.
Fisler, Amos, Harrisburg.
Fleming, Dr. James, Harrisburg.
Flickinger, Samuel, Harrisburg.
Fisher, John R., Harrisburg.
Fox, Richard, Hummelstown.
Feeman, Valentine, Harrisburg.
Fellowes, J. Turney, Scranton.
Fiske, A. R., Harrisburg.
Freeman, William. C., Cornwall.
Gowen, Jas., Mount Airy, Philadelphia.
Grout, H. T., Philadelphia.
Gries, John M., Philadelphia.
Grigg, John, Philadelphia.
Grigg, John Warner, Philadelphia.
Glass, Alex. F., Philadelphia.
Garber, Jacob B., Columbia.
Gillespie, James, Philadelphia.
Gould, J. E., Philadelphia.
Gross, Daniel W., Harrisburg.
Gilbert, Henry, Harrisburg.
Gardner, Jacob, Pittsburg.
Goe, John S., Brownsville.
Goe, John S., Jr., Brownsville.
Gould, Stephen, Williamsport.
Gould, John, Luzerne county.
Gehr, D. O., Chambersburg.
Garis, David, Easton.
Gilmore, Joseph, Williamsport.
Grier, James, Newberry.
Gibson, C. E., Williamsport.
Gould, Robert S., Williamsport.
Gibson, John, Williamsport.
Garman, Samuel, Williamsport.
Gregg, Thomas, Bellefonte.
Gould, Alexander S., Hickory Run, Lycoming county.
Guernsey, H. A., Philadelphia.
Gaynor, Edward J., Easton.
Greenawalt, Alex., Allegheny City.
Glenn, John M'Donald, Pittsburg.
Glenn, Robert W., Noblestown.
Grove, M. M., Harrisburg.
Gohl, A., Harrisburg.
Garman, John, Hyde Park.
Griffin, Henry, Scranton.
Germyn, John, Rushdale.
Gibbs, J. W., M. D., Hyde Park.
Gregory, J. W., Scranton.
Griest, Chas. W., York Sulphur Springs.
Glatz, A. Hiestand, York.
Hammond, John W., Erie.
Haldeman, Jacob S., New Market.
Hiester, A. O., Harrisburg.
Hutchinson, J. Pemberton, Philadelphia.
Hickok, W. O., Harrisburg.
Hacker, William, Philadelphia.
Harvey, Chalkley, Chaddsford.
Haseltine, John, Philadelphia.
Hart, William H., Philadelphia.
Hoopes, Thomas P., Philadelphia.
Hamilton, A. Boyd, Harrisburg.
Hoffman, H. W. Harrisburg.
Haldeman, Jacob M., Harrisburg.
Haddock, D., Jr., Philadelphia.
Hall, George E, Philadelphia.
Hiester, F. A. M., Reading.
Hæhnlen, Frederick, Harrisburg.
Hoffer, John, Harrisburg.
Hamilton, Hayes, Huntingdon Furnace.
Haldeman, S. S., Columbia.
Hicks James, Pittston.
Hutchins, Thomas, Wyoming.
Harvey, B., Wilkesbarre.
Hollenback, Geo. M., Wilkesbarre.
Hitner, Henry S., Barren Hill.
Holstein, William H., Bridgeport.
Hartranft, Samuel E., Norristown.
Hæhnlen, Jacob, Harrisburg.
Hackett, J. M., Easton.
Hetrick, Josiah P., Easton.
Hutter, William H., Easton.
Hartman, John, Williamsport.
Hartman, Matthias, Catawissa.
Herdic, Peter, Williamsport.
Hill, Theodore, Williamsport.
Hall, John B., Williamsport.
Hudson, Joseph E., Williamsport.
Hagerman, Augustus H., Williamsport.
H r, David, Williamsport.
Holden, H. L., Williamsport.
Hays, J. W., Williamsport.

Huling, Louis G., Williamsport.
Hinkle, John R., Newberry.
Higgins, William C., Williamsport.
Huyck, George, Newberry.
Hull, Joseph F., Hull's Mills.
Hepburn, Andrew, Williamsport.
Harinton, Thomas L. Williamsport.
Heylmun, E. G., Crescent, Lycoming co.
Howel, A., Williamsport.
Howland, Rausford, Williamsport.
Hastings, H. S. Williamsport.
Holliday, B. B., Wellsboro'.
Hepburn, John, Williamsport.
Hagy, Philip, Williamsport.
Hull, W. R., Cogan Station.
Hise, Adam, Williamsport.
Hamilton, Cyrus E., Williamsport.
Hoffman, Philip, Williamsport.
Hester, Joseph M., Easton.
Helick, Reuben, Easton.
Higgins, William V., Williamsport.
Hemingway, E. E., Easton.
Hugus, P., Pittsburg.
Hale, James P., Osceola, Clearfield co.
Higgins, William V., Williamsport.
Herr, Henry, Harrisburg.
Hummel, Richard H., Harrisburg.
Hummel, William, Harrisburg.
Hickman, Amos T., Monticello, Illinois.
Hynicka, George, Harrisburg.
Hummel, S. A., Harrisburg.
Hæhnlen, William F., Harrisburg.
Hamilton, Hugh, Harrisburg.
Hargest, William E., Harrisburg.
Horstick, John, Harrisburg.
Herr, D. S., Harrisburg.
Hummel, Alfred, Harrisburg.
Hall, John W., Harrisburg.
Heck, Lewis, M. D., Dauphin.
Hamilton, T. A., Harrisburg.
Hain, Geo., Lower Paxton, Dauphin co.
Hoffman, H. B., Millersburg.
Hunter, George W., Harrisburg.
Hutchinson, J. W., Harrisburg.
Hildrup, W. T., Harrisburg.
Halstead, N., Scranton.
Hill, J. F., Scranton.
Halstead, W. F., Scranton.
Hough, J. L., Erie.
Ingersoll, Harry, Philadelphia.
Irwin, James, Philadelphia.
Innis, John A., Easton.
Jordan, John, Philadelphia.
Jefford, A. M., Wyoming.
Jenkins, G. S., Wyoming.
Jenkins, Steuben, Wyoming.
Jones, Daniel, Exeter, Luzerne co.
Jessup, William H., Wilkesbarre.
Jackson, George D., Dushore, Sullivan county.
Johnson, William, Easton.
Jones, John E., Williamsport.
Jaret, John, Hepburn, Lycoming co.
Jones, Samuel, Williamsport.
Jamison, Edward, Newberry.
Jamison, L., Williamsport.
Jeter, Tinsley, Bethlehem.
Jones, B. F., Pittsburg.
Jordan, Thomas J., Harrisburg.
Kapp, Amos E., Northumberland.
Kramer, Philip, Philadelphia.
Keim, George M., Reading.
Knight, William H., Philadelphia.
Kimball, Stephen, Philadelphia.
Kelly, Charles, Kellyville, Delaware co.
Knox, Thomas P., Norristown.
Knight, Edward C., Philadelphia.
Keller, John S., Orwigsburg.
Kunkle, Benjamin S., Harrisburg.
Knapp, D. B., Williamsport.
King, C. M., White Deer Mills, Centre co.
Kinyon, S. C., Williamsport.
Kunsman, William H., Easton.
Kelly, Dennis, Kellyville, Delaware co.
King, Alexander, Pittsburg.
Kreybill, Jacob E., Marietta.
Knipe, Joseph F., Harrisburg.
Koller, Henry M., Harrisburg.
Kuhn, William, Harrisburg.
Keely, Jerome, Union Deposit, Dauphin county.
Kirby, William C., Harrisburg.
Kepple, John, Harrisburg.
Kirkpatrick, J. D., North Liberty, Mercer county.
Kelker, Immanuel, Harrisburg.
Kimball, John M., Erie.
Lukenbaugh, Chas. Augustus, Bethlehem.
Longstreth, John, Bristol.
Lauman, George M., Harrisburg.
Laguerrene, P. L., Philadelphia.
Lancaster, J. B., Philadelphia.
Linn, Philip, Harrisburg.
Lefrance, Isaac T., Wyoming.
Lee, Washington, Jr., Wilkesbarre,
Leacock, J. R., Wyoming.
Longaker, A. Brower, Norristown.
Line, J. M. Allentown.
Lawall, Edward, Easton.
Lerch, Frederick, Easton.
Logan, Millard F., Williamsport.
Lowe, Ellis S., Williamsport.
Love, Samuel, Williamsport.
Lyon, Thomas, Williamsport.

Lippencott, Edward, Williamsport.
Lentz, George W., Williamsport.
Lehman, M., Williamsport.
Levan, E. M. D., Williamsport.
Long, Henry B., Pittsburg.
Long, W. J., Osceola, Clearfield co., Pa.
Lamberton, Robert A., Harrisburg.
Lauer, Fred'k W., Reading.
Levering, A. D., Philadelphia.
M'Allister, H. N., Bellefonte.
Marshall, William, Bellefonte.
Meredith, James M., West Chester.
M'Kinley, Isaac G., Harrisburg.
Miles, James, Girard, Erie county.
M'Ilvaine, Abram R., Brandywine Manor, Chester county.
M'Gowan, Jno., Bridesburg, Philadelphia county.
Murdock, John, Jr., Pittsburg.
Myers, Joseph B., Philadelphia.
Mellor, Thomas, Philadelphia.
Mellon, Thomas, Philadelphia.
Magee, James, Philadelphia.
M'Cully, Francis G., Philadelphia.
Messchart, H., Philadelphia.
M'Kean, H. P., Philadelphia.
M'Kean, Samuel M., Williamsport.
Martin, George H., Philadelphia.
M'Crea, William H., Philadelphia.
M'Intyre, Peter, York.
M'Farland, John, Ligonier.
Middleton, E. P., Philadelphia.
Magee, George, Philadelphia.
Muhlenberg, H. H., Reading.
Murray, Wm. F., Harrisburg.
M'Alister, Archibald, Springfield Furnace, Blair county.
Metzgar, William, Harrisburg.
Murdock, A. C., Pittsburg.
Merrick, George, Northumberland.
M'Allister, Jno. C., Fort Hunter, Dauphin county.
Maxwell, Henry D., Easton.
Myers, Henry, Forty Fort.
Marcy, Ira, Wilkesbarre.
M'Crea, James A., Philadelphia.
Martin, Dewees J., Allentown.
Mutchler, John, Easton.
M'Minn, J. M., Williamsport.
Mudge, Hiram, Williamsport.
Mundy, J. S., Williamsport.
M'Dowell, Lewis, Williamsport.
M'Cormick, Robert, Montoursville.
Moore, Wesley, Newberry.
Mehaffey, David, Cogan Station.
Mehaffey, Lindsey, Newberry.
M'Micken, J. B., Williamsport.
Miller, Larry, Wayne, Clinton county.
Mahaffey, William J., Newberry.
Maxwell, Jacob S., Williamsport.
Morse, H. S., Williamsport.
Montgomery, J. B., Williamsport.
Mundy, H. F., Williamsport.
Morrison, S. G., Williamsport.
Morris, John C., Friendsville.
M'Cauly, George W., Harrisburg.
Messinger, Samuel, Easton.
M'Cain, Daniel, Allegheny City.
M'Kelvy, Jas., Wilkinsburg, Allegheny county, Pa.
Morris, D. B., Pittsburg.
M'Pherson, J. S., Wilkins.
M'Nish, H. L., Pittsburg.
Marchand, John, Pittsburg.
Magan, David, New Brighton, Beaver co.
M'Farland, John, Northumberland.
Montgomery, Joseph, Harrisburg.
Motter, John, Harrisburg.
Mark, Geo. M., Harrisburg.
Middleton, Richard, Harrisburg.
Miller, William H., Harrisburg.
Mumma, David, Harrisburg.
M'Farland, George F., Harrisburg.
M'Conkey, Elbridge, Harrisburg.
M'Donald, Lewis, Harrisburg.
M'Cormick, David, Harrisburg.
Miller, J. G., Harrisburg.
M'Cormick, James, Harrisburg.
Marvin, Selden, Erie.
Mackey. L. A., Lock Haven.
Morse, L. W., Ledge Dale, Wayne co., Pa.
Newbold, A. T., Philadelphia.
Neilson, Robert, Philadelphia.
Neff, Robert K., Philadelphia.
Newton, G. B., Springfield, Delaware co.
Noble, John, Carlisle.
Noble, F. W., Easton.
Nissley, John J., Hummelstown.
Niceley, George W., Newberry.
Nutting, Lyman, Pine Grove, Schuylkill county.
Nichols, Joseph, Williamsport.
Nichols, W. F., Williamsport.
Neiman, D. H., Easton.
Nissley, Joseph, Harrisburg.
Opp, George S., Moreland, Lycoming co.
Otstott, Jacob H., Harrisburg.
Odenwelder, Henry L., Easton.
Olewine, Benjamin, Harrisburg.
Ott, Leander N., Susquehanna.
Packer, William F., Williamsport.
Prichett, Borradaile, Frazier, Chester co.
Perot, W. S., Philadelphia.
Pratt, Thomas, Philadelphia.

Pennock, Samuel, Kennet Square, Chester county.
Pomeroy, John L., Philadelphia.
Peyson, Auguste, Philadelphia.
Patterson, Robert, Philadelphia.
Physic, Emlen, Philadelphia.
Presbury, George G., Jr., Philadelphia.
Priestly, J. R., Northumberland.
Parsons, H. K., Harrisburg.
Peters, Benjamin G., Harrisburg.
Pennock, Joseph, Pittsburg.
Patterson, Robert H., Pittsburg.
Powel, Robert H., Philadelphia.
Paxton, Joseph, Catawissa.
Polen, Albert, Wyoming.
Peters, C. P., Concordville.
Potts, E. Channing, Norristown.
Parsons, Leroy, Harrisburg.
Pyle, R. C., Easton.
Purcell, Sylvester, Bloomsburg.
Parsons, Henry C., Williamsport.
Pratt, John, Williamsport.
Pollock, Samuel, Williamsport.
Porter, John F., Newberry.
Parker, Samuel J., Williamsport.
Perkins, H. J., Williamsport.
Perkins, James H., Lemar.
Page, A., Williamsport.
Post, G. S., Williamsport.
Parke, John E., Pittsburg.
Patterson, ——, Lebanon Church, Allegheny county.
Phelps, W. H., Pittsburg.
Pemberton, Clifford, Pittsburg.
Phillips, John, Pittsburg.
Power, John, Harrisburg.
Parsons, George W., Harrisburg.
Rogers, C. B., Philadelphia.
Roberts, Algernon S., Philadelphia.
Rutherford, John P., Harrisburg.
Rice, John, Philadelphia.
Rice, William, Philadelphia.
Roberts, Isaac, Norristown.
Rudman, William C., Philadelphia.
Robeson, H. P., Robesonia, Berks co.
Rodgers, Fairman, Philadelphia.
Rhodes, William A., Philadelphia.
Ripka, Joseph, Philadelphia.
Remington, Thomas P., Philadelphia.
Ronaldson, Richard, Philadelphia.
Relf, C. P., Philadelphia.
Rutherford, S. S., Harrisburg.
Rutherford, Abner, Harrisburg.
Reily, John A., Harrisburg.
Robb, Jacob, Pittsburg.
Robinson, ——, Philadelphia.
Rutter, Nathaniel, Wilkesbarre.
Ross, William S., Wilkesbarre.
Rutherford, John B., Harrisburg.
Ruggles, A. C., Williamsport.
Reighard, James B., Newberry.
Reighard, Daniel, Newberry.
Renninger, W. H., Williamsport.
Rook, D. N., Williamsport.
Rank, L. D., Williamsport.
Rouse, William A., Harrisburg.
Reed, Alexander, Lock Haven.
Rodenbough, Joseph S., Easton.
Reeder, Mrs. A. H., Easton.
Richards, Henry, Easton.
Reigel, Joseph, Easton.
Roth, Jeremiah, Allentown.
Rogers, Felix, Pittsburg.
Rowley, Thomas A., Pittsburg.
Russell, Alexander L., Harrisburg.
Rogers, Lucius Smethport, M'Kean co.
Raymond, James, Harrisburg.
Reel, Augustus, Harrisburg.
Rutherford, William S., Harrisburg.
Reel, John, Harrisburg.
Reed, James, Middle Paxton, Dauphin co.
Reichenbach, E. C., Harrisburg.
Rudy, Joseph, Harrisburg.
Rupp, Henry S., Shiremanstown, Cumberland co.
Rutherford, J. E., Harrisburg.
Rhey, George, Millwood, Westmoreland county.
Richmond, William H., Carbondale.
Rand, George W., Scranton.
Rutherford, J. Q. A., Paxton.
Savery, Peleg B., Philadelphia.
Stambaugh, S. C., Lancaster.
Sergeant, William, Philadelphia.
Strouble, Jacob, Zion, Centre county.
Snow, Edward K., Philadelphia.
Sharp, Joseph W., Philadelphia.
Stavely, Wm., Lahaska, Bucks county.
Smith, Daniel, Jr., Philadelphia.
Smith, Thomas, Philadelphia.
Scull, Gideon, Philadelphia.
Simmons, A. H., Philadelphia.
Starr, Isaac, Philadelphia.
Shoemaker, B. A., Philadelphia.
Shaffer, W. L., Philadelphia.
Smith, Geo., Upper Darby, Delaware co.
Sheridan, Owen, Philadelphia.
Swift, Joseph, Philadelphia.
Struthers, William, Philadelphia.
Slade, Alfred, Philadelphia.
Stuart, George H., Philadelphia.
Small, Samuel, York.
Sharwood, Dendy, Philadelphia.
Stone, Daniel, Philadelphia.

Speer, Alexander, Pittsburg.
Stokes, William A., Greensburg.
Sturdevant, E. W., Wilkesbarre.
Shoemaker, Wm. M., Wyoming.
Sturdevant, E. J., Wyoming.
Speece, L. B., Wyoming.
Smith, J. B., Dunmore.
Shoemaker, Wm. S., Wyoming.
Schooley, J. B., Wyoming.
Smith, J. B., Plymouth.
Shoemaker, Elijah, Kingston.
Sharp, John, Jr., Wyoming.
Stark, J. B., Wilkesbarre.
Stephens, Z., Scranton.
Sower, F. D., Norristown.
Schall, David, Norristown.
Schreiber, O. L., Laubach, Northampton county.
Sigman, Joseph, Easton.
Snyder, Daniel W., Easton.
Schreiner, J. W., Lewisburg.
Singer Manufacturing Co., Philadelphia.
Swan, Rufus C., Williamsport.
Sheffler, A. G., Williamsport.
Smith, Henry B. Williamsport.
Smith, Joseph W., Newberry,
Stearns, L. L., Williamsport.
Stewart, Robert, Lemar.
Showers, Jesse, Rauch Gap.
Smith, Thomas, Williamsport.
Showers, D. H., Williamsport.
Smith, Daniel W., Williamsport.
Saxton, J. O., New Kingston.
Shaw, Hugh, Jersey Shore.
Smith, D. J. L., Mill Hall.
Seltzer, George L., Myerstown.
Seitz, George, Easton.
Seitz, Frederick, Easton.
Serch, David, Easton.
Scott, John, Pittsburg.
Sharpless, S. J., Street Road, Chester co.
Smith, George, New York City.
Seiler, Daniel W., Harrisburg.
Shoemaker, John, Harrisburg.
Scheffer, Theodore, Harrisburg.
Smith, Jacob, Harrisburg.
Shaffer, William S., Harrisburg.
Simon, John B., Harrisburg.
Smull, John A. Harrisburg.
Shellenberger, Henry, Harrisburg.
Scott, George, Catawissa.
Sharp, Samuel W., Newville.
Sheck, J. H., Harrisburg.
Silkman, William M., Scranton.
Shaw, James C., Neshannock.
Sheesley, William F., Harrisburg.
Silverthorn, M. H., Fairview.
Thompson, John I., Half Moon, Centre county.
Thomas, George, Belvidere, Chester co.
Thatcher, Richard, Marsh, Chester co
Toppan, Charles, Philadelphia.
Thompson, N. B., Philadelphia.
Tatham, H. B., Philadelphia.
Tatham, George N., Philadelphia.
Towers, William H., Philadelphia.
Taggart, David, Northumberland.
Taggart, John, Northumberland.
Tasker, Thomas T., Philadelphia.
Tripp, Ira, Scranton.
Trout, Michael C., Sharon, Mercer co.
Tyson, Carrol S., Norristown.
Thomas, Henry, Harrisburg.
Templin, James R., Easton.
Taylor, Benjamin H., Williamsport.
Taylor, Horace E., Williamsport.
Thompson, James, Cogan Station.
Trump, Edward D., Jersey Shore.
Tinsman, Garret, Williamsport.
Tinsley, Jeter, Bethlehem.
Thayer, Russell A., Allentown.
Templin, William, Harrisburg.
Taylor, William, Womelsdorf, Berks co.
Taylor, B. Frank, Womelsdorf.
Taylor, George R., Womelsdorf.
Tracy, John A., Erie.
Urquehart, John, Wilkesbarre.
Updegraff, A., Wilkesbarre.
Updegraff, Thomas, Newberry.
Updegraff, Daniel, Newberry.
Updegraff, Derrick, Newberry.
Unger, David J. Harrisburg.
Unger, John G., Harrisburg.
Van Leer, Isaac W., Wallace, Chester co.
Vouges, James C., Philadelphia.
Vanvoorhis, H. B., Pittsburg.
Vanscoy, Daniel, Wyoming.
Van Vorce, John, Williamsport.
Van Buskirk, S., Williamsport.
Vandike, James, Northumberland.
Walker, George, Montrose.
Watts, Frederick, Carlisle.
Walker, R. C., Elizabeth, Allegheny co.
Wood, Robert, Philadelphia.
Waterman, Joseph, Philadelphia.
Wister, Richard, Philadelphia.
Watson, Johanna, Philadelphia.
Welsh, William, Philadelphia.
Welsh, John, Philadelphia.
Welsh, Samuel, Philadelphia.
Woodward, George W., Philadelphia.
Weaver, H. A., Pittsburg.
Wright, Joshua, Washington county.
Watson, A. W., Harrisburg.

Walters, S. H. Northumberland.
Wright, Joshua, Findleyville, Washington county.
Waggoner, J. A., Harrisburg.
Waterman, Albert G., Philadelphia.
Wood, Thomas, Penningtonville.
Woodhams, Samuel, Plymouth.
Williams, Stiles, Wilkesbarre.
Wright, H. B., Wilkesbarre.
Wetherill, William, Norristown.
Wentz, Thomas H., Norristown.
Witman, Joseph, Centre Valley P. O.
Williams, E. C., Harrisburg.
Woodward, John V., Williamsport.
Watson, Oliver, Williamsport.
White, Henry, Williamsport.
Wolf, Peter, Williamsport.
Wingard, Samuel C., Williamsport.
Watson, Henry W. Williamsport.
Weaver, M. B., Williamsport.
White, John, Williamsport.
Wait, B., Williamsport.
Wood, James M., Williamsport.
Westcott, Thos. S., Ashland, Schuylkill county.
Ward, C. L., Towanda.
Werkheiser, Enos, Easton.
Wallace, W. W., Pittsburg.
Withington, W. P., Shamokin.
Way, John, Jr., Pittsburg.
White, J. A. G., Osceola, Clearfield co.
Wallower, John, Harrisburg.
Winters, George, Harrisburg.
Wolfinger, Levi, Harrisburg.
Wible, William, Gettysburg.
Watts, William M., Mechanicsburg.
Warford, A. B., Harrisburg.
Wolf, William, Harrisburg.
Wilhelm, A., Cornwall.
Walker, John H., Erie.
Yeager, Joseph, Philadelphia.
Young, Alexander, Philadelphia.
Yeaton, William H., Philadelphia.
Youngman, George W., Williamsport.
Young, William, Easton.
Young, John, Jr., Ewing's Mills, Allegheny county.
Young, James, Middletown.
Ziegler, John H., Harrisburg.
Zimmerman F., Williamsport.
Zimmerman, A. M., Harrisburg.
Zerbe, Cyrus, Harrisburg.

OFFICERS

OF THE

PENNSYLVANIA STATE AGRICULTURAL SOCIETY.

FOR 1876.

PRESIDENT.

George Scott, Catawissa.

VICE PRESIDENTS BY CONGRESSIONAL DISTRICTS.

1. James A. M'Crea, Philadelphia.
2. George Blight, Philadelphia.
3. A. L. Kennedy, Philadelphia.
4. William S. Bissell, Philadelphia.
5. A. D. Levering, Philadelphia.
6. David H. Branson, Coatesville.
7. William H. Holstein, Bridgeport.
8. Tobias Barto, Reading.
9. S. S. Spencer, Lancaster.
10. Daniel H. Neiman, Easton.
11. Joseph P. Conner, Fowlersburg.
12. Ira Tripp, Scranton.
13. Lyman Nutting, Pinegrove.
14. John A. Smull, Harrisburg.
15. James E. Carmalt, Montrose.
16. J. B. Potter, Wellsboro'.
17. Sylvester Baker, Altoona.
18. John S. Miller, Huntingdon.
19. Daniel O. Gehr, Chambersburg.
20. Levi A. Mackey, Lock Haven.
21. George Rhey, Millwood.
22. John Murdoch, Jr., Pittsburg.
23. Alexander Speer, Pittsburg.
24. Joshua Wright, Washington.
25. J. B. Lawson, Lawsonham.
26. J D. Kirkpatrick, North Liberty.
27. John W. Hammond, Erie.

ADDITIONAL MEMBERS EXECUTIVE COMMITTEE.

Artimeus Wilhelm, Cornwall, Lebanon county.
Abner Rutherford, Paxton, Dauphin county.
John S. Keller, Orwigsburg.
Benjamin G. Peters, Harrisburg.
R. S. Allen, Mercer.

EX-PRESIDENTS MEMBERS OF THE BOARD.

Frederick Watts, Carlisle.
David Taggart, Northumberland.
Jacob S. Haldeman, Harrisburg.
Thomas P. Knox, Norristown.
A. Boyd Hamilton, Harrisburg.
Amos E. Kapp, Northumberland.
John C. Morris, Scranton.
Jacob R. Eby, Harrisburg.

CORRESPONDING SECRETARY.

Elbridge M'Conkey, Harrisburg.

RECORDING SECRETARY.

D. W. Seiler, Harrisburg.

TREASURER.

John B. Rutherford, Harrisburg.

CHEMIST AND GEOLOGIST.

S. S. Haldeman, Columbia, Lancaster county.

ASSISTANT CHEMIST AND GEOLOGIST.

Hugh Hamilton, Harrisburg.

LIBRARIAN.

William H. Egle, Harrisburg.

MINUTES OF THE EXECUTIVE COMMITTEE.

LANCASTER, *September* 30, 1875.

The meeting was called to order by the president. Present Messrs. M'Crea, Bissell, Levering, Branson, Holstein, Barto, Spencer, Cowner, Tripp, Smull, Miller, Gehr, Rhey, Murdoch, Speer, Lawson, Kirkpatrick, Wilhelm, Abner Rutherford, Peters, Knox, A. B. Hamilton, Kapp, Eby, Hugh Hamilton, J. B. Rutherford, M'Conkey, Egle and Seiler.

The reports of the several committees on awards were read, approved and amended as shown by awards made.

On motion of Mr. Seiler,

The executive committee proceeded to the consideration of subject of holding an exhibition of the society for the year 1876. When on motion of Mr. Barto, it was referred to the committee on location, with power to act and report to the executive committee at their meeting in January.

A resolution of thanks was offered by Mr. Egle to the citizens of Lancaster for their kindness and courtesy shown the officers and committee of this society during their stay and exhibition.

On motion, adjourned.

D. W. SEILER,
Recording Secretary.

HARRISBURG, *January* 18, 1876.

The fourth quarterly meeting of the society was called to order by the president, the following members present: Messrs. M'Crea, Branson, Holstein, Spencer, Neiman, Conner, Tripp, Smull, Gehr, Murdoch, Wright, Lawson, Kirkpatrick, Abner Rutherford, Keller, Knox, A. B. Hamilton, Kapp, Eby, Hugh Hamilton, Egle, M'Conkey, J. B. Rutherford and Seiler.

The minutes of the last meeting were read and approved.

Mr. Eby read the following communication from B. Landreth, Chief of the Bureau of Agriculture Centennial Exposition, in relation to the position of this society in the coming exhibition at Philadelphia:

JANUARY 3, 1876.

GEORGE SCOTT, ESQ.,

President Pennsylvania State Agriculture Society:

SIR:—In view of your annual meeting, I address you in reference to the work of this bureau, in developing and organizing the agricultural display of the International Exhibition.

Upon assuming, on the 25th of February last, the duties devolving upon me as chief of the Bureau of Agriculture, my first efforts were to develop interest upon the specialties pertaining to the department.

With that purpose in view, I prepared and distributed to agricultural papers and to individuals, independently of the general regulations and circulars of the commission, thirty-five thousand special circulars upon agricultural machinery, live stock, pomology, forestry, fish culture, and also as to the rules and regulations, pertaining to the administration, of this department.

The correspondence with parties designing to exhibit has been quite large and has developed the fact that the preparations made for the display of goods will be entirely inadequate to supply the demands for space.

The area of available space for exhibition purposes within the Agricultural Building, allowing for main passage ways, which have been reduced to a minimum, amounts to 236,672 square feet. Of this area 89,000 square feet have been applied for by the following countries: Great Britain, France, Germany, Austria, Norway and Sweden, Russia, Belgium, Netherlands, Spain, Italy, China, Japan, Siam, Sandwich Islands, Chili, Brazil, Mexico, Canada, and to them will probably be added applications from other governments. The remaining area of 147,572 square feet, subject to still further reduction by the establishment of passage ways, necessary to the proper display of objects, is the space remaining at the disposal of the bureau for the accommodation of home exhibitors, whose applications even now exceed the area of *the entire building* by 10,000 square feet.

The percentage of reduction upon requisitions for space, consequent upon the pressure for room, has averaged fifty per cent., in some cases far exceeding that rate.

The number of exhibitors in the United States section is very nearly one thousand, and is greatest in the special class comprising agricultural machinery, under which there are, to date, four hundred exhibitors and requisitions for 90,000 square feet.

A large proportion of the agricultural machinery will be exhibited in motion, power being transmitted to the building by suspended wire cables from engines of two-hundred horse power, located in a special structure at a suitable distance.

The display of goods in manufactured forms will cover almost as extensive an area as agricultural machinery, and will be of a highly interesting character.

The next largest display will comprehend the direct products of the soil, and will exhibit very fully the varied character of soil and climate comprehended within our borders.

The group comprising Forestry and Pomology will display even more fully than that of farm products the vast range of climatic influences, and cannot fail to inpress foreigners with our fruit resources.

Another interesting group will be that comprehending the display of Fish and the varied apparatus and appliances both for the culture and capture of fish. Here it is contemplated to have aquaria containing all the fresh and salt water fishes of our coasts, rivers and lakes. The processes of breeding and feeding thoroughly displayed, affording an exhibition both interesting and of deep practical value.

The remaining five groups are well filled, and, as in the case of the others, the objects will be displayed in artistic form.

Under all the groups are entered objects of crude and bulky character, and it is highly probable that they will have to be placed in an annex of very considerable area.

The collective exhibitions to be made by various State Centennial Boards will, it is expected, be placed in the annex, as their requirements for space which have not yet been made, will doubtless be large, and, as has already been stated, individual requisitions more than fill the agricultural building.

Live stock will be exhibited in serial show, commencing on September 1st, and continuing till November 10. This display will be made within an enclosure of twenty-two acres, leased by the Commission and in close proximity to the main entrance to the Centennial grounds. The stock yard is most eligibly located for the reception and shipment of animals by rail as well as for its accessibility to visitors.

The space is sufficient for the location of a ring and the erection of one thousand stalls, which number will be quite sufficient, inasmuch as only animals of one race are to be exhibited at one period.

Set trials of speed will not be allowed; the ring being conclusively for the purpose of exercising the animals and for the use of the judges in determining points of character. Only such animals as are of absolute purity of blood, (excepting trotting stock, fat and draught cattle) will be admitted; a cardinal object being to promote improvement in breeding stock.

During the months of June and July will be held trials of harvesting machinery. Forty-seven acres of land have been leased and drilled in wheat, and an equal area of grain land on adjoining farms is secured for the use of the Commission. Fifty acres of grass land have been leased and on adjoining

farms additional space of almost equal area conditionally secured for trial of mowers, tedders and hay rakes. It is anticipated that these trials will be quite exhaustive and each extend over a period of ten days.

The bureau has received most efficient aid and counsel from gentlemen of the advisory committee whose time has been patriotically given for the benefit of the cause in which all are so deeply interested.

Your society can greatly aid the exhibition by offers of special prizes for the display of objects of particular interest to its members, collectively and individually; for instance, the various cattle clubs could bring about a more thorough display of live stock by the offer of a herd prize for each of the respective breeds. Individual breeders may offer at the same time, prizes for the most perfect single animals. Similar prizes could be offered by persons interested in the improvement of the various breeds of horses, sheep and swine.

Agricultural societies of the various States by offering a series of prizes for displays of cereals, feeding roots, fibres and other objects of agricultural interest would create a spirit of competition among the citizens of each State, and of praiseworthy rivalry of the several States in the exhibition of farm products, live stock, and machinery, which would be of present interest and advance the future good of the whole Union.

Dairymen's Association could more fully show the advanced character of their specialties by offers for butter and cheese, in such forms and of such grades as would interest producers and consumers.

Poultry Fanciers by an offer of a prize for the best collective special display of fowls of each species, would develop a wider and more interesting competition.

Fruit Growers and Nurserymen could also produce active competition in the display of pomological products.

Seed Merchants by offering special prizes for the best collection or special display of field and garden produce would stimulate the producers of such articles to increased effort to excel.

Such a series of prizes as herein mentioned, though simply offered as examples, for the field is very wide, and might comprise competition in machinery, in displays of insects injurious to vegetation, in specimens of comparative dentition of domestic animals, in sheep shearing, in plowing, in horse shoeing, would develop much interest inasmuch as the successful competitors would not only receive the special prizes thus offered, but as the most meritorious exhibitors, would also receive the reward from the International Jury.

PRIZE ESSAYS.

Though the Centennial Commission will make awards to the exhibitors of the most meritorious objects of agricultural character, both in the normal

or natural state, and in manufactured form, it does not contemplate the reception of essays upon agricultural topics nor the appointment of judges upon such papers, but may it not promote and strengthen the interests of agriculture if there were offered prizes for essays upon such subjects connected with rural affairs as considered by you of general interest.

The prize essays adjudicated by an umpire selected by the party offering the prize, might be read at a Farmers' Centennial Convention held at Philadelphia during the session of the great exhibition.

The subjects comprehended within the range of these essays, it is suggested, should comprise Tillage, embracing rotation of crops and application of fertilizers as one subject; Dairying, Stock Breeding and Management; The Efficiency of Farm Machinery, having respect to cost; Of Organization and Union Promotive of the Common Interest; Veterinary Science and Farriery; Bee Culture; Fish Culture; Forestry; Pomology; Grasses and Forage Plants; Draining for Health and Profit; Fencing and Laws Operating in Various States Touching Cattle; Trespass on the Highway, and upon Dogs Running at Large; Construction and Ventilation of Farm Dwellings and Buildings; Improvements in Agriculture; Monographs upon the Various Breeds of Neat Cattle, Sheep, Swine. The successful essays to be the exclusive property of the party granting the prize.

The incentive thus offered to agricultural writers of ability would probably develop much competition, not for the money value as for the facility offered to place themselves prominently before the farmers of the Union and of the world.

The society might also offer special prizes to farmers possessed of farms of special merit, under the following classification:

PRIZE FARMS.

1st. An award will be offered for the best cultivated farm of not less than one hundred acres, exclusive of wood and waste land, mainly devoted to grain growing, regard being had to the quantity and quality of produce, the manner and extent of cultivation and actual products.

2d. An award will be offered for the best cultivated farm of not less than one hundred and fifty acres, exclusive of wood and waste land, mainly devoted to grazing and cheese and butter dairying, regard being had to the quantity and quality of produce, the manner and expense of cultivation, and especially to the management and feeding of stock and conducting the dairy, and the actual products.

3d. An award will be offered for the best cultivated farm of not less than one hundred and fifty acres, exclusive of wood and waste land, mainly devoted to the production of agricultural seeds.

4th. An award will be offered for the best cultivated farm of not less than one hundred and fifty acres, mainly devoted to breeding of live stock.

5th. Awards will be offered for the best crops of wheat, rye, oats and corn; also for the best crops of roots for stock breeding, as beats, marigolds, carrots, parsnips and sweets.

In connection with these suggestions, I am authorized to publish the following acceptances:

The Jersey Cattle Club will pay to the exhibitor of the best herd of cattle of that breed, one thousand dollars.

The Produce Exchange of Philadelphia will pay to the exhibitor of the best cheese, one hundred and fifty dollars.

Messrs. B. K. Bliss & Sons will pay two hundred dollars for the best display of potatoes, in pecks.

Messrs. D. Landreth & Sons will pay one hundred dollars for the best display of vegetables, at a stated period.

Messrs. Henderson & Sons will pay one hundred dollars for the best display of tomatoes, at a stated period; also fifty dollars for the best essay on the culture of celery; also fifty dollars for the best essay on the culture of cauliflower.

Mr. Landreth will pay seventy-five dollars for the best essay on the subject of "Forestry."

Many other parties are about to make similar offers.

The moneys to be paid over to the officers of the Centennial Commission and by them handed to the successful competitors.

I trust your society may look favorably upon the proposition.

When, on motion of Mr. M'Crea, it was

Resolved, That the communication of B. Landreth, chief of the Bureau of Agriculture, be referred to a committee of three, in conjunction with the president of this society, who shall be empowered to offer such premiums by the Pennsylvania State Agricultural Society as in their judgment may best conduce to the interests of agriculture and maintain the credit of the society: *Provided*, The amount of said premiums does not exceed ($1,000) one thousand dollars.

The president appointed as said committee Messrs. M'Crea, Spencer and Seiler.

Mr. Smull called the attention of the committee to the death of Paschall Morris, vice president, an active member of this society. After a lengthy eulogy, Mr. Egle offered the following, which was unanimously adopted:

Resolved, That we have heard with unfeigned sorrow the death of Paschall Morris, editor of the *Practical Farmer*, and an honored member of the executive committee of this society.

2d. That in the demise of Mr. Morris progressive agriculture and scientific farming have lost a warm and earnest friend, an eloquent advocate, and this society an industrious co-laborer.

3d. That in testimony of the many virtues of Mr. Morris, and of our high appreciation of his valuable services to agriculture, science, his acknowledged abilities as an editor, his uprightness of character and goodness of heart, these resolution be placed upon the minutes of the society.

4th. That a copy of these resolutions be forwarded to the family of Mr. Morris.

Mr. A. B. Hamilton offered the following, which was agreed to:

Resolved, That this Executive Committee recommend to the incoming representatives of the Pennsylvania State Agricultural Society the propriety of omitting the annual exhibition of 1876, for the reason that the common desire of the citizens of Pennsylvania is to contribute to the success of the commemoration during this year of the completion of the first century of our Republic as a nation.

Resolved, That a committee of three be appointed to lay this resolve before the executive committee of the society elected for 1876, at its first meeting.

The president appointed as said committee Messrs. Hamilton, Gehr and Neiman.

Mr. Hamilton moved that the president appoint a committee of three to audit the accounts of the treasurer; also, appoint a judge and two tellers to conduct the annual election. Agreed to.

The president appointed on accounts, Messrs. Eby, Murdock and Conner; on elections, Rutherford, Kirkpatrick and Branson.

Mr. Knox moved that hereafter this committee shall meet quarterly at 2 o'clock in the afternoon. Agreed to.

Mr. Smull moved that when we adjourn it will be to meet at 10 o'clock to-morrow morning.

On motion, adjourned.

D. W. SEILER,
Recording Secretary.

HARRISBURG, *January* 19, 1876.

The meeting was called to order by the president, Mr. Scott, who desired to say to the committee that as he was a member of the State College board, which was to meet at this time, he therefore requested this committee to select one of its members to act as presiding officer for a short time, when, upon motion, A. B. Hamilton acted as president *pro tem.*

Dr. Edge, a member of the Legislature from Chester county, was introduced to the committee by Mr. Knox, and requested to submit his views for the consideration of the society. Dr. Edge then read a bill which he proposed to present to the Legislature: "An Act to incorporate a State Board of Agriculture." He also fully explained the object of the bill and what changes were necessary and the object to be attained.

The thanks of the society, on motion of Mr. Knox, were tendered to Dr. Edge for the interest he has taken in the cause of agriculture.

On motion, adjourned.

D. W. SEILER,
Recording Secretary.

HARRISBURG, *January* 19, 1876—2:00 P. M.

The annual meeting of the society was called to order by Mr. Seiler, who moved that Mr. Murdoch act as chairman, which was agreed to.

The hour fixed to open the polls having arrived the officers appointed to conduct the election took their places.

Mr. Seiler moved that hereafter the names of the treasurer and recording secretary be placed upon the annual ticket to be voted for at each election the same as other officers. Was unanimously agreed to.

Mr. Holstein moved that hereafter the polls be open from ten (10) to twelve (12) o'clock A. M. on the third Wednesday of January of each year, at which time the annual elections shall be held.

Mr. Haehnlen moved to amend and insert twelve (12) M. to two (2) o'clock P. M. After considerable debate Mr. Haehnlen withdrew his amendment and the original motion of Mr. Holstein was agreed to.

The report of the Treasurer was then read and approved.

JOHN B. RUTHERFORD, *Treasurer, in account with the Pennsylvania State Agricultural Society.*

DR.

Jan. 20, 1875. To balance in treasury	$3,477 11
Cash from J. R. Eby, interest	15 00
Life membership, W. W. Speer	20 00
Annual membership, J. B. Lawson	2 00
Cash, rent Harrisburg gas company	50 00
Cash, Farmers' and Mechanics' Institute, Easton	98 66
Cash, sale buildings Park grounds, Harrisburg	100 00
Cash, Dougherty Bros., interest	31 25
Proceeds exhibition at Lancaster from the sale of single admission, yearly memberships, &c	11,808 28

State appropriation	$2,000 00
Cash, J. R. Eby, interest	60 00
	17,662 30

CR.

Rent of office, eighteen months	$600 00
Printing	1,198 59
Expenses of executive committee	1,001 90
Expenses of president's office	71 92
Expenses of secretary's office, clerks, stationery, &c	775 19
Expenses of treasurer's office, clerks, ticket-sellers, &c	617 68
Premiums, 1874	49 00
Premiums, 1875	3,661 00
Medals	123 77
Superintendents, labor, &c	725 10
Preparation of grounds	479 00
Transportation, tents, &c	673 78
Entertainment of committee	299 50
Lumber and carpentering	1,077 74
Forage	547 78
Police	552 00
Salary recording secretary	500 00
Salary corresponding secretary	500 00
Salary treasurer	250 00
Balance	3,958 35
	17,662 30

The undersigned, committee to audit the accounts of the treasurer, beg leave to report that we have examined the vouchers and find them correct.

(Signed) J. R. EBY,
J. P. CONNER,
JOHN MURDOCH, JR.

The hour of four o'clock having arrived, on motion of Mr. Knox, the meeting adjourned, after receiving the report of the officers appointed to conduct the election.

They then reported as follows:

ANNUAL MEETING OF THE
PENNSYLVANIA STATE AGRICULTURAL SOCIETY,
HARRISBURG, *January* 19, 1876.

We, the undersigned judge and tellers appointed to conduct the annual election of the State Agricultural Society, beg leave to report the result as

indicated, the candidates receiving the number of votes opposite their names.

President:	Votes.
George Scott	61
Vice Presidents:	
1. James A. M'Crea	61
2. George Blight	61
3. A. L. Kennedy	51
C. D. Evans	1
W. H. Vodges	8
4. William Bissell	61
5. A. D. Levering	61
6. David H. Branson	61
7. William H. Holstein	61
8. Tobias Barto	61
9. S. S. Spencer	61
10. Daniel H. Neiman	61
11. Joseph P. Conner	61
12. Ira Tripp	61
13. Lyman Nutting	61
14. John A. Smith	61
15. Jas. E. Carmalt	61
16. J. B. Potter	61
17. S. Baker	61
18. Jno. S. Miller	61
19. Daniel O. Gehr	61
20. L. A. Mackey	61
21. George Rhey	61
22. John Murdoch, Jr	61
23. Alexander Speer	61
24. Joshua Wright	61
25. J. B. Lawson	61
26. Jos. Kirkpatrick	61
27. Jno. W. Hammond	61
Additional Members of Executive Committee:	
A. Wilhelm	..
Abner Rutherford	61
J. S. Keller.	61
Benjamin G. Peters	61
R. S. Allen	61

Ex-Presidents Members of the Board:

Frederick Watts..... 61
D. Taggart..... 61
Jacob S. Halderman..... 61
Thomas P. Knox..... 61
A. Boyd Hamilton..... 61
Amos E. Kapp..... 61
John C. Morris..... 61
J. R. Eby..... 61

Corresponding Secretary:

Elbridge M'Conkey..... 61

Chemist and Geologist:

S. S. Halderman..... 61

Assistant Chemist and Geologist:

Hugh Hamilton..... 61

Librarian:

Wm. H. Egle..... 61

[Signed.] ABNER RUTHERFORD,
Judge.
DAVID H. BRANSON,
J. W. KIRKPATRICK,
Tellers.

On motion of Mr. Haehnlen the meeting adjourned.

D. W. SEILER,
Recording Secretary.

HARRISBURG, *January* 19, 1876.

The newly elected Executive Committee met at the adjournment of the annual meeting. President Scott in the chair. Present: Messrs. Branson, Holstein, Neiman, Conner, Tripp, Smull, Gehr, Murdoch, Wright, Lawson, Kirkpatrick, Abner Rutherford, Knox, A. B. Hamilton, Kapp, Eby, Hugh Hamilton, Egle, Rutherford, M'Conkey and Seiler.

Mr. Knox informed the committee that he had a conversation with some of the gentlemen of the Committee on Agriculture of the House of Representatives, who requested him to state to this committee that they desired to have the assistance of its members and officers in framing a bill to protect sheep from being killed by dogs, and that therefore he moved that Mr. Hamilton and Kirkpatrick act as a committee, on behalf of this society, to frame and present such a law to said Committee on Agriculture. On motion, the name of Mr. Knox was added to said committee. Agreed to.

Mr. Hamilton, as chairman to present to the newly elected committee the resolutions passed by the old committee to consider the advisability of not holding its annual exhibition for the year 1876, reported and offered the following resolution:

Resolved, That in view of the decision of the Society, not to hold its annual exhibition in 1876, that when this Committee adjourn it will be until the third Tuesday of January, 1877, at two o'clock in the afternoon, unless the President shall deem it expedient to call a special meeting of the same: *Provided however*, That if such special meeting shall be called, the Society shall be at no expense for the mileage or other expenses of the Committee during such special meeting to be held at Philadelphia on the call of the President. Not agreed to.

Mr. Smull offered the following as an amendment, which was agreed to:

Resolved, That in view of the decision of this Society, not to hold its annual exhibition in 1876, that this Committee adjourn until the third (3d) Tuesday of January, 1877, at two o'clock P. M., unless sooner called by a committee to be appointed as follows: Consisting of the President, the two Secretaries and the members of the board, to whom shall be referred all matters relating to disputed premiums and all other subjects relating to and effecting the interests of the Society. Said committee to take into consideration the question of obtaining the requisite contributions necessary to obtain the State appropriation and to carry out such plans: *Provided*, That in calling the Excutive Committee together there shall be no expenses paid to any members thereof, and the expenses of this committee to be paid by themselves.

President appointed Messrs. Scott, M'Conkey, Seiler, Smull and Barto said committee.

Mr. Kirkpatrick moved that D. W. Seiler and John B. Rutherford be declared duly elected as Recording Secretary and Treasurer of this Society for the year. Agreed to.

Mr. Knox moved that the salary of the Recording Secretary and Treasurer be fixed at the sum of twenty-five dollars ($25 00) for the year.

On motion of Mr. Branson it was amended that the amount to be paid be fixed by the Committee at their next meeting, and that the amount paid be regulated by the services rendered. Agreed to.

Mr. Kirkpatrick moved that the following resolution be adopted, which, after considerable discussion, was agreed to:

WHEREAS, The interests of the practical agriculturists of Pennsylvania will be greatly subserved by the holding of a State trial of agricultural implements:

And whereas, The approaching Centennial exhibition is not likely to offer premiums for the superior practical excellence of one piece of agricultural machinery over another of the same kind :

And whereas, The demands for a State trial of implements has been long and continued ; therefore,

Resolved, That a committee of five members of this body, in addition to the president and secretaries, be appointed to represent and act for the Pennsylvania State Agricultural Society in making arrangements for and carrying out the details of a trial of implements, at such time and place during the ensuing summer as may be deemed expedient, and to appoint a committee to adjudge the several articles entered for competition, and award prizes therefore : *Provided,* That a sufficient number of membership tickets be guaranteed by exhibitors and others to defray the expenses thereof.

President appointed the following as a committee : Messrs. Scott, M'Conkey, Seiler, Kirkpatrick, Smull, Branson, Barto and Neiman.

The following resolution was offered by Mr. Smull :

Resolved, That the officers of the society be requested to make every effort to obtain from the several railroad companies orders for tickets over their several roads at one-half fare for the members of the board. Said orders to be issued only by the recording secretary.

Agreed to.

Mr. Engle moved that the president and secretary of this society be directed to issue a circular addressed to the agriculturists of the State, urging them to make a proper representation of the great interests of Pennsylvania at the exhibition at Philadelphia.

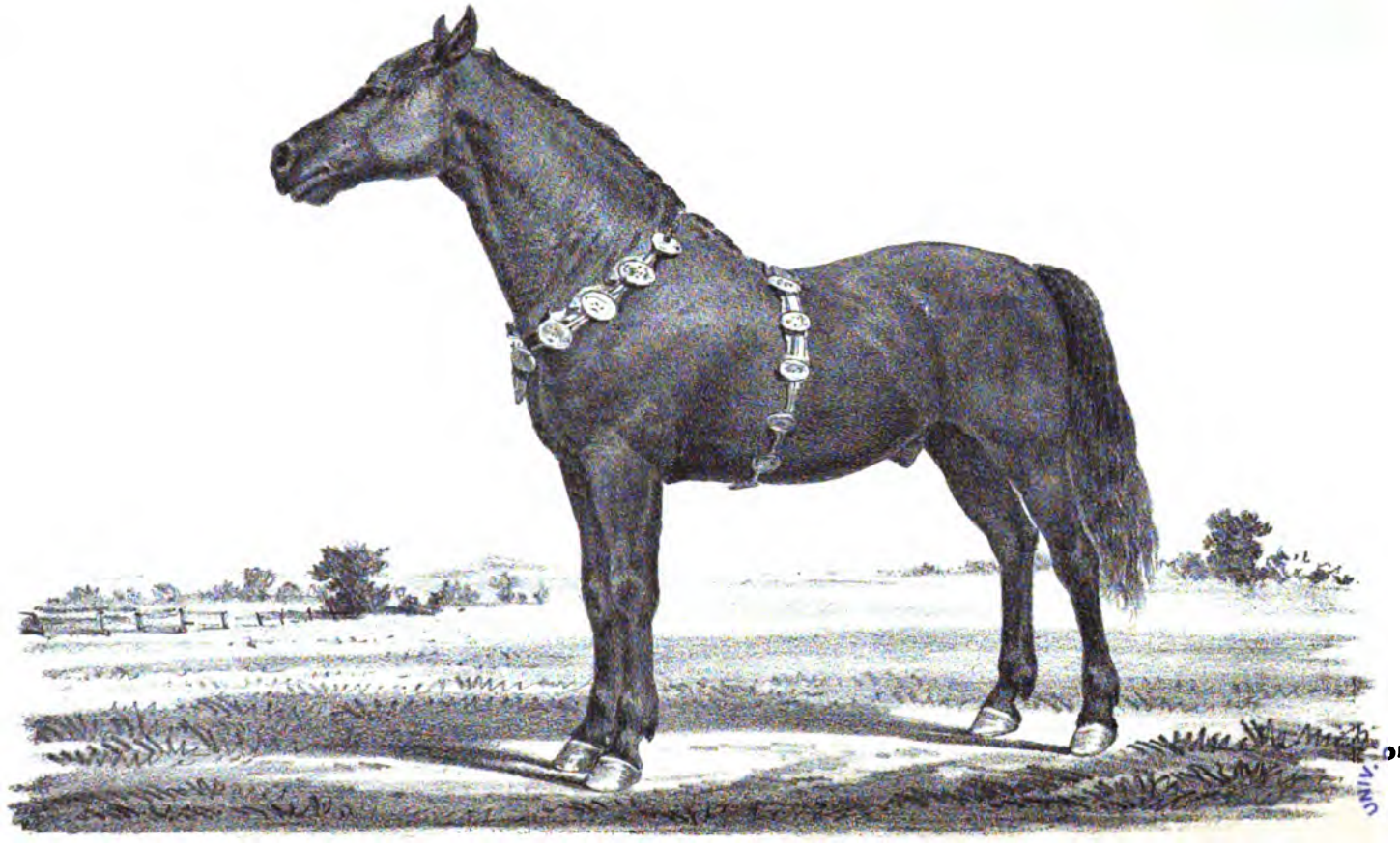
Agreed to.

Mr. Lawson moved that Messrs. Seiler, Eby and Rutherford act as a committee, to whom full power shall be given, to rent a room for the coming year for use of this society.

On motion of Mr. King, adjourned.

D. W. SEILER,
Recording Secretary.

EXTRACTS FROM PAPERS OF THE SOCIETY.



BRITISH SPLENDOR.

International Exhibition – Live Stock, Philadelphia, 1876.

UNIV. OF MICH.

LIME—ITS ACTION, USE AND ABUSE.

ANONYMOUS.

The fact that our farmers and practical men differ so widely in their views as to the value and use of lime, has often been adverted to by agricultural writers as a proof that we, as a class, are not careful enough to investigate into such matters, but are apt to arrive at conclusions without proper data to support them. This is in by far too many cases correct—we too often base our practice upon the mere opinions of another, without knowing how correct they may be or whether they are supported by facts.

No doubt much of the difference of opinion as to the value and use of lime arises from an improper understanding of its mode of action or from a want of thought to a few plain and invaluable rules. In alluding to the theory of the action of lime, one of our best authorities thus seems to cover the whole ground. He writes:

First.—It supplies a kind of inorganic food which appears to be necessary to the healthy growth of all our cultivated plants.

Second.—It neutralizes acid substances which are naturally formed in the soil and decomposes or renders harmless other noxious compounds which are not unfrequently within the reach of the roots of plants.

Third.—It changes the inert vegetable matter in the soil so as gradually to render it useful to vegetation.

Fourth.—It causes, facilitates or enables other useful compounds, both organic and inorganic, to be produced in the soil, or so promotes the decomposition of existing compounds as to prepare them more speedily for entering into the circulation of plants.

In the application of lime, we too often place too much value upon action first, as given above. It is true that lime enters more or less into the composition of all of our cultivated crops, but with a few exceptions the amount is so small that there are but few soils so different in this element as not to be able to supply the needs of an indefinite number of crops. Taking a crop of twenty-five bushels of wheat per acre as our starting point, we find that an equivalent crop of each of the kinds given below will remain in the grain and roots the amounts opposite.

Wheat	1.5 lb.
Barley	2.1 "
Oats	2.5 "
Turnips	25.0 "
Potatoes	3.3 "

From this it is plain that the grain crops removed during an ordinary rotation carry off but a very small amount of lime, which can be replaced by a very slight application every ten years. It is true that the straw and leaves contain a much larger percentage, but as these are usually returned to the soil in some form or other, they as an item of exhaustion are not fairly chargeable. Analysis proves that the straw and leaves of the following crops, when produced in amounts equivalent to twenty-five bushels of wheat per acre, contains lime as follows :

Wheat	7.2 lbs.
Barley	12.9 "
Oats	5.7 "
Turnips	47.0 "
Potatoes	130.0 "
Clover hay	110.0 "

It is evident that the small proportion of lime which even under the most favorable circumstance can enter into the composition of the crop, will not account for all the results attained by its application.

In a long list of a careful analysis of a number of soils by a competent chemist, I find the lowest proportion of lime to be fifteen-hundreths of one per cent. ; to add this much lime to a soil entirely destitute of it and six inches in depth would require but 1,800 pounds, which would supply the usual crops for a long series of years. In the usual application of 50 bushels per acre we add over two and one-half tons of lime in the form of a hydrate —enough to supply all the wants of the crops for several hundred years.

Passing to the second chemical axiom given above we come to the consideration of the chemical action of lime upon injurious compounds which it meets in the soil. Nearly all such compounds are in some form of combination with an acid and this combination, by the stronger affinity for the acid as possessed by the lime, is broken up—new compounds are formed and the old base set free either to enter into the composition of the crop or to enter into a new alliance, thus forming some other compound. Much of the valuable plant-food in the soil (unorganic) is locked up by an acid whose effect is to deprive the plant of the power of using and assimulate the base ; if lime comes in contact with such an element a change takes place—a new and valuable compound is released or formed, and a portion of the old elements released ; this new compound may be of itself beneficial or it may work good results in the action of the portion set free. To illus-

trate this mode of action, I need only refer to the action of what is known (best perhaps in England) as the "lime and salt mixture." Lime when applied to a given area produces a certain result in the product. Salt produces on a similar area another result; if the two are thoroughly mixed for six months before applying and laid on double the area, the beneficial result is much increased; this chemists tell us is due to a change of pasture or the constituents of the lime and soil, which change results in the formation of two other and more valuable compounds. This is only what may take place in one soil where lime is intermixed with it; a competent chemist could furnish us with a long list of compounds common in the soil upon which the action of lime would be as above given, but for our purpose the one illustration is sufficient.

Another effect of lime, which is analagous to that mentioned above, is its power of rendering material, which was previously insoluble, soluble and available to the needs of plants. The farmer on the heavy Kentucky bottoms will tell us that a liberal application of lime will cause his crops to go down, and by preventing a proper filling up of the grain will diminish the yield and that immense crops of straw will be produced at the expense of the grain. On the other hand, the farmer who has a light sandy soil will assert that with heavy application of manure, lime will stiffen his straw and increase his crop of grain. No doubt this seeming contradiction is due to the fact that on the sandy soil the lime renders the silica (the stiffening ingredient of straw) more soluble and available for the plant, while on the heavy land it acts upon the inert organic matter, and not having a proper supply of silica the latter is deficient. The affinity of lime for sulphuric acid is so strong that it is safe to say that it will decompose almost any sulphate with which it comes in contact, and robbing it of its acid will set the base free. In low wet soils some of these sulphates (that of iron for instance) exist in such proportions as to be injurious to the growth of crops. Lime, by the action just alluded to, in breaking up these compounds often produces an immediate and wonderful effect on such soils and benefits the farmer more by the harm which it prevents than by any element which it adds to plant growth. Nearly all soils contain large percentages of partially decomposed granite, felspar and other rocks containing potash in various combinations. Lime will break up these compounds and by releasing the potash furnishes a valuable and often lacking element of plant food.

Another important action of lime (probably the most important of all) is its ability to hasten the decay and decomposition of vegetable or organic matter in the soil, and by a proper appreciation of this mode of action we may, no doubt, solve many of the seemingly contradictions which so often meet us in the application of this aid to success. One of our usually cor-

rect authorities asserts plainly, that "lime retards the decay of woody or vegetable matter," and another, quite as good an authority, says: "On the other hand, lime hastens the decay of all vegetable material." Strange as the contradiction may seem, it is very probable that both are right. If we mix caustic lime with dry straw, chips or other vegetable matter, and carefully exclude all earthy matter we will find that it will "retard the decay of woody matter," but if to the compound are added a portion of common soil and supply moisture, we will find that lime "hastens the decay of vegetable matter." The farmer who, without adding any vegetable or organic matter to his soil, continues to apply lime, will find that his crops will decrease with each and every application in spite of the expense of, perhaps, his nearest neighbor (who has a soil rich in such matter, or who adds it in the form of manure), and he is at a loss to account for the contradiction of results. In its natural state the vegetable matter of our soil is only very slowly made available for the needs of the crops, and the province of lime is to increase the action wherein adds to its preparation; hence he who applies lime without adding organic matter in a corresponding degree, is exhausting his principal instead of being content with an increased rate of interest.

A by no means unimportant action of lime is its ability or power to change the natural products of the soil; so far does this go that our practical farmers regard the appearance of cinquefoil and sour grass or "sorrell" as a certain index that the soil needs lime. In England the appearance of the corn-marigold (chrysanthemum segeteem) is an index of the need of lime; these plants by their vigorous growth indicate that the soil needs lime because certain acids upon which they thrive exist in such amounts as to interfere with the growth of non-acid living plants: a proper amount of lime neutralizes these acids, and not finding their proper food the five-finger and sorrell disappear or give way to more useful plants. On the other hand the English farmer finds that lime added in excess or in too large amounts encourages the growth of injurious plants to the exclusion of those more desirable: the Worcestershire farmers claim that in such cases it encourages the growth of coltsfoot and red poppy.

The effect of lime seems not only to be to improve the quantity or yield of our principal crops but it also improves their quality: the one exception to this rule is the flax crop and other crops raised for their fibre alone: in Belgium no farmer presumes to sow flax sooner than in from six to ten years after lime has been applied—the crop is somewhat increased in amount but the fibre is injured to a much greater degree. Prof. Johnson (J. F.) claims that it hastens the maturity of the crop, but those who have soils rich in vegetable matter will hardly agree with him in this; its action on

such soils is such as to very materially retard the ripening of the crop and to increase the succulence of the straw or fodder.

To the practical farmer it is evident that the action of lime will in great measure depend upon the former condition in which it is applied. In the first place the composition of the stone from different quarries varies very much, and this of course more or less affects the product. The best grades of stone contain 57 pounds of lime and 43 of carbonic acid in each hundred, and the various grades vary from this up to the magnesian stone, which may contain 57 of carbonate of lime and 40 of carbonate of magnesia, the difference between the sum of these and 100 being made up of sand, clay and other impurities. The latter when burned will yield nearly as much magnesia as lime. If a load of each of the two is deposited in adjacent piles, and allowed to remain until fit to spread, the magnesian lime will have killed the grass underneath it, and will have so affected the soil that little or nothing will grow on it for a number of years. So far as my practical experience goes, I would make this a test and exclude the magnesian lime when a purer form can be procured. From the properties given above we may assume that one ton of limestone will furnish twelve hundred pounds of nearly pure lime. This when allowed to become air slacked only will have increased its bulk about two and a half times, and its weight about one-fourth. It will then consist of lime 76 and water 24 pounds, and is known to the chemist as hydrate of lime. The mixture of lime and magnesia will increase nearly one-half in weight (the increase varying with the percentage of magnesia) and in bulk almost at the same rate. For practical work the main fault of magnesian lime is that with water it forms a cement which rapidly hardens and becomes valueless as plant food or in the producing this food.

If lime is allowed to remain exposed to the weather after it has passed into the hydrate form it continues to absorb the carbonic acid driven off by burning, and sooner or later regains its insoluble form as in the original stone. When slacked in the open field in heaps the outer portions of the pile have progressed past the hydrate form before the central or inner portions have reached it, and hence there is a loss which may be prevented by placing the lime under cover and allowing it to obtain the requisite amount of carbonic acid from the air alone. Perhaps it would be still better to crush the lime fresh from the kiln, but this has not yet been proven. In all cases a too prolonged exposure to the air results in a loss in chemical, manurial and mechanical action, which should be avoided if possible.

All our authorities seem to agree that in the original form of limestone, however free, it produces little or no effect, and that its greatest effect is available when it has absorbed almost twenty-five per cent. of water.

As to the proper time in the rotation at which to apply lime there seems to be much difference of opinion, but I think that a strict attention to a few rules, which are so certain in their action that they may pass as axioms, will enable us to decide the question properly.

As before stated, lime hastens the decay of all kinds of vegetable and organic matter with which it meets in the soil, hence it is but reasonable to suppose that it will produce its greatest action when this kind of material is most abundant. This is certainly either when a good sod has been turned under for corn, or when manure has been applied for the wheat crop to be followed by grass. As an axiom which must not be lost sight of, and which may modify the result, we have the fact that lime has a powerful effect in decomposing animal manures and freeing the ammonia; if absorbents are present in proper amounts there may be no loss, but it is safest to keep barn-yard manure and lime at some distance apart in order to ensure good conduct. Those who mix caustic lime with the manure from their chicken houses may thus account for the powerful odor of the mixture, its most valuable element escapes and is lost. It must also be remembered that lime, like other manures and stimulants, takes some time to act. This time varies with the lime from different quarries, some acting so quickly as to resemble animal manure, and others requiring a full year before showing much effect. It is probable that the effect (average) in either case is about the same; those which act immediately after they are applied are exhausted first, and the others are more prolonged in their action.

This naturally brings up the question as to how long an application of lime will show its presence by its effects. In England and on the continent where it is customary to lease lands for from five to twenty-eight years it is usual for the lease to provide that the tenant on leaving shall receive a compensation for manures laid on during the last few years of his lease; in these leases the period fixed for the exhaustion of a coat of lime varies from five to ten years; that is, if a tenant applies lime during the last year of his lease his landlord or the incoming tenant must repay him from four-fifths to nine-tenths (in accordance with the number of years fixed by the terms of the lease,) of the cost of the lime as a fair compensation for its unexpended value No doubt some soils are affected by lime for at least twenty years after the application but it would seem that practical experience proves that after a lapse of ten years it will pay to lay on another dressing; many apply lime once during each rotation of from seven to eight years and claim that it is needed at least this often; others apply it at every other rotation once in fourteen years, but much depends upon having the proper kind of material to work upon. If organic matter is not added in the form of animal manure or grass once in fourteen years is too often but if the proper supply of plant-food is kept up once in seven years is none too often.

The abuse of lime has led to the old saying that "lime enriches the father at the expense of the sons," and in certain cases and certain modes practice it is no doubt true, if the fathers draw upon the principal the sons must suffer, but if they use only the interest the inheritance may go down to the sons unimpaired in amount.

I have already alluded to the chemical action of lime in forming new combinations in the soil as being the source by which it is exhausted; in addition to this there are two other causes about to diminish the supply. Lime sinks into and through the soil into the sub-soil, and once below the reach of the plow much of its good effects are lost entirely. Lampadius mixed lime with a given depth of soil until it contained 1.19 per cent. In one year it had decreased to 0.89 per cent.; in two years to 0.52, and in three years to 0.24 per cent. The theory of the sinking of lime does not seem to be properly understood, but has been credited to the fact of the greater specific gravity of the lime, but in many cases the difference in this respect between the lime and a heavy soil is so slight as to but partially account for the effect.

From what I have stated in the earlier portion of this essay, that in applying lime at any particular time some preference should be had with regard to the crop to be produced. If the soil contains enough lime for the wants of the crop, it would be useless, so far as manurial value is concerned, to apply more; but if analysis is to be depended upon, it would seem that there were few soils that would not be benefited by an application of lime for a crop of potatoes or turnips. It is true that in these crops by far the largest percentage is in the leaves and tops, but without these are healthy and vigorous it is useless to expect a good crop of roots or tubers.

When we take into consideration all the causes which assist in the exhaustion of lime it would seem that the best time for its application is to the sod preceding the plowing for corn; at this time the sod furnishes a large amount of vegetable matter in the form of roots; if deleterious compounds have been formed in the soil they then exist in their greatest amounts; the frequent plowings and workings which the soil receives during the three or four succeeding years in great measure prevents any loss by sinking, and effectually mix the lime with the soil: and what is of quite as much importance the fall is a leisure season, when such a job hinders the regular farm work to its least extent.

Much as they differ as to the proper time for making the application it is probable they differ still more as to the proper amount to put on at one time. In eastern Pennsylvania it would seem that fifty bushels per acre was the most common amount, but we find many who apply but twenty-five and others seventy-five; in England and Scotland much larger amounts are used,

and Johnson mentions applications of two hundred bushels as not uncommon in Scotland, and instances cases of even more with apparent advantage. No doubt the proper amount will depend much upon the soil, and that loose arable land will bear much more than wet heavy clays; in all cases we record of injury from too much lime, it has been in low wet ground or on heavy clay land. When no actual injury follows, it seems reasonable that large applications will for a time enable the soil (if rich in organic matter) to produce greatly increased crops for a time, but if organic matter is not added in a like proportion the crops will decrease, and the land will be left in an impoverished condition. In many of our limestone districts there seems to be a strong tendency towards smaller and more frequent applications. This point is so very forcibly illustrated in the following from Prof. Johnson, (J. F.,) though it takes an extreme seldom reached in this country, yet of use in a like proportion. He writes: "Suppose two acres of the same dry land to be limed respectively with 200 bushels each, and that the one is cropped for twenty years afterwards without further liming, while the other at the end of every five years is dressed with an additional dose of 40 to 50 bushels. In both cases the land would have attained the most productive condition in five or six years. Let us suppose that in this condition it produces annually a crop (or equivalent to nutritive value) 30 bushels of wheat, and that on neither acre did a sensible diminution appear before the end of ten years. Then during the second ten the crops would gradually lessen on the one acre, while in consequence of the re-addition of the lime as it disappears the amount of produce would remain sensibly the same in the other acre. Suppose the produce of the former gradually to diminish from 30 to 20 bushels during these ten years—or that while the one has continued to yield 30 bushels during the whole period, the other has on an average yielded only 25 bushels during the latter ten years. If now the second large dose of 200 bushels be added to this latter acre, the cost of liming both will have become sensibly the same, but the amount of produce or of profit from the two acres during the second ten years will stand thus:

10 crops of 30 bushels=300 bushels.
10 " " 25 " =250 "

A difference in farm of frequent liming of 50 bushels per acre or nearly two whole crops every lease of twenty years."

The same authority thus sums up the effect of lime upon the organic matter of the soil:

First.—Lime has little or no effect upon soils in which organic matter is deficient.

Second.—Its apparent effect is inconsiderable during the first year after its application, when compared with that which it produces the second and third year.

Third.—That its effect is most sensible when it is kept near the surface of the soil and gradually diminishes and becomes less as it sinks towards the subsoil; and

Fourth.—That under the influence of lime, the organic matter in the soil disappears more rapidly than it otherwise would do, and that after it has disappeared fresh additions of lime produce no effect.

From these and other facts the chemist draws the following conclusions: "It is obvious from these facts that *in general*, the main beneficial purpose served by lime is to be sought for in the nature of its chemical action upon the soil—an action which takes place slowly, but which is hastened by the access of air, and which causes the organic matter itself ultimately to disappear."

USE OF THE MICROSCOPE IN TESTING MILK, CREAM, CHEESE, &c., AND AS A FARM TOOL.

READ BEFORE THE AMERICAN DAIRYMEN'S ASSOCIATION, BY PRESIDENT SEYMOUR.

Human sight is dull and weak. Out of the many objects and movements around us we see but few. The air and water are filled with animal and vegetable organizations invisible to us. Plants change and grow under our eyes, but we do not see the process. Even large objects are viewed in mere outlines; we do not with our feeble visions learn their texture and real nature. It does not teach us the character of our own bodies. We know nothing of the structure of the skin upon our hands, or the hair upon our heads until they are shown to us by artificial helps. In truth, we live in a dim twilight on the outer edge, as it were, of the swarming active life which fills the earth, but which we cannot detect with our unaided senses.

What we do not see, not only exceeds many thousand fold what our visions show us, but invisible things are the most active agents in the work going on around us. The rocks waste away, the mountains are melted down, the seas filled up, mineral matter is changed into vegetable growth, the vegetable changes we owe earth in the past and which are still going on, are wrought out by causes so minute that we do not discern them, although the work is done in our presence. The pestilences which carry death into our homes are frequently caused by minute animal or vegetable organizations which enter our dwellings in the clear light of day, but we do not perceive them, and wonder why our friends sicken and die. On the other hand, the farmer gets the reward for his toil by the help of nature, which works in secret ways showing results in full harvests made by processes which are dark to us. If we study out the number of things we cannot see, and their importance to our health and happiness, we find that with few exceptions we are groping in the dark.

I do not doubt that this is wisely ordered, and that it is in the main for man's well being, when we take into account the fact that he is gifted with faculties which enable him in a good degree to overcome the evils of feeble vision. The work of keeping our senses is one which gives happiness, which trains and strengthens our minds, and which elevates us into a moral and intellectual dignity and worth. If our eyes were microscopic we would see too much for mental or moral strength. Enough is done for us when we are put in the way of finding out matter for ourselves, and when, above-

all, we are endowed with the power which enables us to enlarge the scope of our mental and physical action. To let these talents lie buried is a crime against the laws of our being.

To none of these senses have art and science given such aids as they have to sight. Magnifying glasses have been brought to a high degree of perfection. The most powerful, which are called microsccpes, will magnify many thousand times. They show animals living in air and water which to natural eyes are free and clear from any object, and they show that these myriads of existences are of the most varied character, and have laws of life not only unlike but positively at variance with those with which we are familiar. By the aid of the microscope we have found out a great many of nature's secrets, and we are in the way of learning many more. We also begin to use her processes. We turn them to account in the arts and sciences, so that we get not only mental pleasure, but we also make business gains.

Of still greater importance to us is its use in studying the laws of human life. Physic and surgery have made great strides with its aid. It is used in most workshops and factories. It has become a great practical instrument, giving power to one of the most valuable of our senses, and those who use it have a great advantage over those who do not.

My object now is to show that the microscope must be made a "farm tool;" that it is a practical working machine and will pay as well as other tools; that it will help the farm as much and the farmer more than any other labor saving machine; that it will give new value to every other implement and will lead to many inventions of use to him.

In the first place I will speak of its value to that class of farmers who make cheese. We have had interesting addresses from men of science upon many things connected with this branch of business. They have given interest, value and dignity to the proceedings of this association. Our reports have been sought after from all parts of our own country and Canada and many have been sent to Europe. You will bear in mind that most of these addresses have been based upon facts learned by the aid of the microscope. We have been told of things of great importance about matters under our own eyes which we did not see, because our eyes had not the power to show them to us. We have learned truths from other men about the business, because they had a tool we did not keep. What they saw they told us about, and we learned as men learn from a description. But why should we not see for ourselves? Words can give only hazy ideas. Our address cannot meet all questions coming up in our minds. Hearing once, is not like seeing many times. Listening does not stamp things upon our mind like looking. The mind of the scientific man does not move on the same level or run in the same grooves that ours do, and

it is therefore hard to keep the thread of the discourse. Why should we not use our own senses and know accurately, rather than use another man's senses and learn from him inaccurately? What stands in the way of this? Not the cost of an implement that ranges from fifty cents to fifty dollars; from the price of a dozen cigars up to the average bet on a horse race at a county fair. The cheapest will not show much, but they will expose the want of cleanliness in milk, and will give a new view to many objects. Would learn men to look and reason, and in the end lead them to use better instruments and to engage in more elaborate researches. The more costly microscopes need some skill in their use. A little time and practice will make this easy. All the reading and study connected with them can be canvassed in a few winter evenings. There is some trouble at first with high powers, but the eye and the hand will soon get trained.

Under our system of making cheese in factories, we look to their managers for all the skill they can give. We also expect that they will give their patrons such facts as they need to do their part in making a good article for market. They come short of their duty, if they fail in either of these two respects. In listening to its debates, I am struck with the fact, that all agree upon certain points, but all complain, year after year, that the admitted evils have not been cured. For instance, all say there must be cleanliness in milking and in cans; all have a common interest in this; all mean to live up to its requests, but the evil continues. Why is this? Is it not due to the fact that each man has his own ideas of cleanliness, and each lives up to his own standard? If one of them is charged with uncleanliness, he feels deeply wounded, and bitter angry strife is engendered. What cleanliness is, is a matter of opinion. Now apply the microscope to the can, or to some minute deposit in its crevices. It shows to the eye that it has the germs of animal or vegetable growth, which will increase and multiply with wonderful rapidity through the great mass of milk with which it comes in contact. That puts an end to the trouble. The man finds out he is wrong in a way that does not touch his pride. The cheese maker does not find it necessary to say an unkind thing. On the contrary, he can excuse this fault if it is not kept up. If it is, after making it clear to his eyes, then cut all dealings with him.

Much has been said in our debates about aerating milk, but little is done to carry out the practice. Is not this due to the fact that the need of aeration is not made clear to the mind of farmers? But show them the tendency of milk to catch from other substances, or to engender in itself fungus plants and infusions; let them see through a microsope how swiftly they spread, and what conception they can work through a large vat of milk from a small quantity of infected milk, then show to his eyes that pure air passing through the milk will, in a good degree, kill these poisonous

growths, and they get a clear, distinct idea of the value of aeration. When our senses show them that air mixed with milk does not merely cool it, but that is death to the germs of many corruptions. For this reason many foul things cannot live in running water which fill up stagnant pools with unhealthy animal and vegetable life. After that when he forces air through his milk he sees that he is killing reptiles. Men can never be converted from evil ways until they get a clear idea of wrong-doing. It is hard to carry out a shadowy definite idea; it is hard to resist one that is clear, strong and clean cut.

A good microscope in each cheese factory in the hands of one who could use it and who would collect objects for patrons to look at, would be an easy, cheap way to work out most of the reforms at which we aim on the part of our farmers. We should see with the instrument how our cows take into their system swarms of animal and vegetable corruptions when they drink from stagnant pools. We should see the germs of poisonous life floating in the air from decaying animal and vegetable matter. We should know what killed not only the stock but the families. The word uncleanness would mean something to us and we should bear its import in mind.

Let us go inside the factory. He who undertakes, for a price, to work up the milk of a neighborhood, is bound in good faith to do so in the most skillful way. It is his duty to learn all he can about the business, and he has no right to neglect or reject anything which will increase his power to do the best work. If the microscope will show his eyes facts which he and others should know, then he ought to have one, and he should learn how to use it. Now we know it will do all these things. At our last meeting Mr. Arnold, in a very able and interesting address, proved, by the aid of this instrument, what made porous cheese. He had drawings of objects, so that all was made clear to our sight, and thus made clear to our minds. If he had not used his glass, he would not have found out those facts. If he keeps on with its use, he will find out many other valuable facts, and he will teach them to others. Now any man can do this same thing, and any cheese-maker ought to follow his example. If there were a thousand microscopes at work in our factories, we should not be left groping in the dark about the causes of all the trouble in cheese-making. I do not say they would be seen at once, but a thousand visions, intensified by art—a thousand minds, made clear and penetrating by thought and investigation would, in a little time, give us a skill which would command the markets of the world.

I said the microscope should be a farm tool. As cheese making is a branch of farming it will not be out of place to say something of the use of this instrument to agriculture generally. It is strange, that while

it is used in almost every other industry, that so little is thought of by those who live in the midst of these objects and who lean upon those substances upon which it throws the most light. It shows the structure of the plants he raises, the character of the enemies, the nature of rust and blight, the habits of the insects which destroy the fruits of his toil. There is not a thing about a farm which a man will not understand better if he looks at it with a vision magnified a hundred fold. It is a liberal education which any one will get who will carry a magnifying glass in his vest pocket, which he will use on any subject that come in his way.. It will give him a new view of the world. His farm will be a museum of wonders. Everything we understand gives us pleasure. No one has studied out with a glass the peculiar structure of any tree, that did not feel a sense of pleasure ever after in looking at it. It needs more guise to live on a farm than in town. Farmers are for a good part of the time alone and by themselves. When a man is alone by himself he should try to be with an intelligent person of good morals and a cheerful disposition. And he will have all these if he gets acquainted with the animal, vegetable and mineral world around him, which he can get by the use of his vision when it is so stengthened by art that we can look into so many of the secrets of nature. In most cases it is the empty head which leads the man to leave the country for city life.

Insects, rust or a blight are great enemies to farmers. They are mostly too minute to be clearly seen by the naked eye. It is a great point gained to be able to see what your enemy is and what he is doing. We have also numerous friends in insect life who wage war upon our enemies. We ought to know our friends and their habits, but we can only do so by the use of magnifying glasses. The potato bug, which is working great evil at the west, is coming this way. Our fields will be swept by them unless their insect enemies shall muster their forces in time to hold them in check. We ought at least to know our allies in the fight with these foes of the farmers.

It is one of the greatest mistakes of the farmer that, as a rule, they suffer the buyer to know more about the quality and value of farm produce than is known by those whose labor makes them. The buyer has tests which the farmer does not have. I notice that when the wool buyer comes around he takes out his glass and sees at a glance the structure of the article in hand and knows more about it than he who has toiled a year in its production. The same is true of seeds. The magnifyer is applied to pork to see if it is infested with trichina. I think it is true, as a rule, that the buyers of farm products know more about them than the producers. The man who knows the most always gets the best of the bargain. It is certain that knowledge is power in making a trade. It can safely be put down as a rule that a man who, for natural or artificial reasons, can see a hundred times as much as his neighbors, will know the markets.

FARM FENCING.

In reply to the question, "What is the best plan for Centre county farmers to pursue in regard to fences, taking the laws as they now exist?" Professor John Hamilton, of the Agricultural College, in Centre county, replies:

The best plan for Centre county farmers to pursue in reference to fences, taking the laws as they now exist, is a question about which there is little, if any, difference of opinion, if opinions are to be judged by appearances. If we go to the tops of some of our mountains and look down upon the broad valleys that lie beneath, with their miles upon miles of fertile fields, and their cultivated acres numbered by the thousand, no feature of the landscape is more likely to strike our eye, or attract our attention, than the vast net-work of fences that covers the surface, dividing into all imaginable shapes and sizes, the territory that lies before us. Dotted here and there all over the view are the homes of the farmers; and their lands, embracing from one to two and sometimes three hundred acres, usually extending in all directions from the dwellings, are not only separated by fences from the property adjoining, but are themselves divided by interior partitions, until in some instances the homes are so shut in from the highways by gates and bars and barricades, and cut off from neighbors by fields and lots and pens and yards, and similar enclosures, as to remind one of the Labyrinths of Ancient Crete.

If you go upon the farm and ask the owner why he thus barricades himself behind this *chevaux de frise* of fences, shutting out his friends, and repelling the social dispositions of his neighbors, he will, doubtless, with a look of pity for your simplicity, tell you that these are a necessary part of the equipment of every well regulated farm, and that no man would for a moment think of paying full price for land destitute of good substantial inside fences. This usually silences all discussions and the enquirer goes away, and too often follows the teachings he has received.

Your committee, either from sheer contrariness or possibly from inability to see just why these statements, made so frequently by those who advocate the sub-division of their farms, should forever put the matter beyond dispute, have appointed me to institute a search, and see whether there may not be a better way that that practiced by farmers at the present time, and to bring before you here to-night the result of my investigations.

The question that they have proposed for answer is, "*What is the best plan for Centre county farmers to pursue in reference to fences, taking the laws as they now exist?*"

This law, as it now stands, requires that farmers in Centre county shall fence against all animals running at large on the public roads, and against all animals in their neighbors' fields; or in other words, the law requires that fences along the highways shall be tight, high and in good repair, and that line fences shall be constructed and maintained at the mutual expense of individuals owning adjoining lands.

These then are, in brief, the conditions under which your committee ask their question. Without disputing the wisdom or justice of these enactments, I will confine myself to the discussion of the particular point submitted. *"What is the best plan to be pursued with reference to fences, under these laws?"* By *best* I suppose is meant, that plan which shall pay the largest percentage on the capital and labor employed, with the least injury to the land and trouble to the owner. And since the question implies that there are more plans than one that may be pursued, it would seem essential that some at least of the most generally accepted plans should be carefully considered and compared. I have thought it well to bring to the discussion of this subject those appliances and methods of calculation, that have been found useful and even necessary in other professions in life. Whilst it may be true that *"guess work is the best when it hits right,"* yet mathematical precision will continue to be used in all enterprises where accuracy and close attention to details are essential to success. Farmers have a way of lumping things that is rather startling to men trained to arrive at conclusions by the slower process of reasoning, and accustomed to know just why they believe the things they do. Let the figures then tell the story, and inasmuch as we are wholly desirous of arriving at correct conclusions I ask that errors in calculation, if there are any, may be carefully observed so as to have them brought up for correction when the general discussion of this subject comes before us.

The plan most generally pursued by Centre county farmers to-day consists in the subdividing of farms into a number of fields containing from eight to ten, or twenty acres, and in raising upon these fields certain different crops, succeeding each other in a rotation occupying from four to seven years. The usual number, however, being five. The plan further consists, and this is the part with which we have specially to deal to night, in a system of pasturing stock upon the fields, which necessitates the separation of these divisions by means of interior fences to protect certain growing crops from the encroachments of the cattle. As these enclosures are erected, not through the requirements of law, but of the farmer's own accord and for his own special purposes of convenience and accommodation, they thus legitimately come within the scope of the inquiry presented for our consideration.

Since the best plan for a farmer to pursue with reference to his fences, must be the one by which the best results can be obtained with least expense; it becomes necessary in examining any system in comparison with others that first of all we shall ascertain what it costs. One panel of post fence eleven feet long and five rails high will cost one dollar and ten cents. Add the price of half a panel, fifty-five cents, and we have one dollar and sixty-five cents as the cost per rod.

Take about an average farm, rectangular in form and containing one hundred and eighty acres, being within a fraction of one hundred and ninety-six rods long by one hundred and forty-seven rods wide, divided into twelve fifteen acre fields forty-nine rods square, with a lane one hundred and ninety-six rods long, one-half of its length to be thirty-three feet wide and the other half to be twenty-feet in width. There will be one thousand and twenty-four rods of inside fence.

If you multiply this by $1 65, the cost per rod, you will have a total of $1,689 60, as the first cost of the inside fences of this one hundred and eighty acre farm. This fence with ordinary care will have to be entirely renewed once every twenty years. In order to find its cost we must calculate compound interest on the principal invested. This first cost at compound interest for twenty years amounts te $5,418 77, which gives an average annual loss of $270 93, in maintaining these inside fences.

To this must be added compound interest on the land occupied by these fences, equal by careful calculation to $10 22 per year.

To this again there must be added the year's loss upon the land taken up by lanes, that would be farmed were it not for the fences at the sides, which amounts to 148½ rods of land. This at $60 per acre, amounts to $55 68, the compound interest on which for twenty years would by $122 89. This divided by twenty would give a yearly loss of $6 14. There yet remains the item of yearly repairs, a matter, as every farmer very well knows, of no inconsiderable consequence in estimating his annual expenses. Owing to the great difference of opinion among farmers as to the amount of this expense, and in the absence of any correct data from which to discover it, I have been compelled to estimate; and preferring to err by an under rather than by an over estimate, have supposed that an average of at least $5 per year would be expended in these repairs.

We have then, as the total cost per year of ten hundred and twenty-four rods of fence, not including taxes, gates or cost of clearing fence rows, the sum of $292 29, an amount equal to the net yearly income from upwards of thirty-six acres of wheat; or by losing this amount for twenty years, you will have lost $5,845 80. In other words, a young man buying a farm of one hundred and eighty acres, at $60 per acre, could, in twenty years, pay $5,845 80, by simply doing without his inside fences.

Startling as these statements are, they by no means tell the entire truth. There are circumstances of inconvenience and loss of time, although commonly overlooked, or considered as but trifles by farmers, which are so directly chargeable to the inside fences, that I would be neglecting my duty to you, and be unfair in my treatment of the subject, were I to pass them by without attention. Farmers, in a general sort of way, know that it takes somewhat longer, in proportion to the number of acres, to plow a small field than a large one. But few ever calculate just how much is thus lost, or investigate the cause.

Let us stop a moment and see what this 1,024 rods of inside fence has now cost per year. We have

1-20 the original cost of the fence, with the compound interest added for twenty years	$270 93
Interest on land occupied by fences	10 22
Do.....do.....lanes	6 14
Yearly repairs	5 00
Losses by additional turning	63 44
Do.....tramping at the ends in turning	17 97
Making a total of	373 70

Lost each year by fences, not including taxes, on the land so occupied, cost of removing weeds, briers, &c., in amount lost by snow banks that prevent early working in the spring, and sometimes destroy the grain by smothering. What is all this expense for? $373 70 per year. Farmers certainly are not foolish enough to throw away this amount of money simply because they can afford to do it. What is all this expense for? Why a farmer answers, "to protect our grain fields from our cattle." Is this all? Is it possible that it must cost $373 70 each year to keep our cattle off our grain? How many cattle, let me ask, do you keep on this one hundred and eighty acres, six, ten, twelve, fifteen head? Say fifteen head are kept, that is six milk cows and nine young cattle. The question that now arises, is, are they worth it? Are these fifteen head of cattle worth what they cost? Let us stop and see.

Six cows at $40 each	$240 00
Nine young cattle at $20 each	180 00
Total	420 00

You can get $420 for them at a sale to-day, and this is all that they will bring. What income do they bring in? Five, ten, twenty, fifty per cent.? Say that one can realize fifty per cent. This would amount in the six months during which you pasture to $105. That is, in order to make $105 you spend annually $373 70; curious economy. It is something like Mark

Twain's account of Henry Ward Beecher's farming, "bought a hog for $8, fed him $30 worth of corn; sold the hog for $15. Made on the hog, lost on the corn."

Farmers, have you ever counted what your cattle cost you? Take six head of cows and nine young cattle, they will require at least two acres each of pasture during the summer, or two of your fifteen acre fields, besides the picking that they get from the corn fields in the early fall. This land should produce at least one ton of hay to the acre, worth (at $10 per ton), $300. In order to keep these cattle during the winter, there will be required two tons more of hay apiece, worth at the same price, $300 more. These cattle, in order that they may be well kept and thrive, will require grain equal to about six bushels of corn apiece, making ninety bushels, which at fifty cents per bushel, would amount to $45 00. To these amounts add $25 20, the interest on $240 00, the money invested in the cattle, and we have a total cost per year of $670 20. In this estimate the manure is supposed to pay for the attendance. Let us now see what they will produce. Willard, the highest authority on Dairy Husbandry, states that the average annual quantity of milk from each cow, as shown by statistics, is 1,800 quarts, and that it takes an average of eighteen quarts of milk to make a pound of butter. According to this statement, each cow will yearly produce 100 pounds of butter, which, at twenty-five cents, will be $25 00, and this multiplied by six—$150 00. The milk and butter milk are usually worth but little except as food for calves and pigs, say half as much as butter, $75 00; increase in one year in value of young cattle, $15 00 each, $135 00, making in all $360 00. From these statements your cows have cost you $670 20, and have produced $360 00, leaving as net loss for food alone for fifteen head of cattle, $310 20; that is, their food has cost you $310 20, more than your cattle have produced, and this does not count possible losses by death or accident. Now let us sum up again and see where we are:

Fences cost annually	$373 70
Cattle cost annually	670 20
Making a total of	$1,043 90
Cattle produces	360 00
Leaving a total loss per year of	$683 90

or $263 90 more than the cattle are worth. It is very evident that the more stock a man keeps in this way the worse he is off. When you question the owner of this 180 acre farm respecting his condition, he complains that his lot in life is severe, that he has to work as hard as he can drive, early and late, year in and year out, that he cannot live as men in other professions live, that he must stint and scrape and economize and scratch.

That he must labor, and his wife must toil and slave, and notwithstanding this, that he is growing poorer every year. Judgments are being entered up against his property, store bills are over due, children must stay at home from school, nothing can be contributed when the church calls for benevolence, clothes are old and worn, buildings need repair, land needs clearing and improving, implements and machinery are worn out and useless, and all about him is in a sadly dilapidated state. When asked why he does not fix up and better his condition, he tells the truth when he replies "too poor." Why is it that you are so poor? Look at just one o your investments:

In cattle	$420 00
And as a consequence of this you have expended on inside fences	1,689 60
In all	2,109 60
Upon this investment of $2,109 60, you lose yearly on food of cattle	$310 20
On fences	337 70
Total	683 90

or nearly one-third of the whole amount invested. Is it any wonder that you are poor, when you actually throw away nearly seven hundred dollars every year in one department of your business? Is it not marvelous that you have been able to hold out so long? How long, think you, could a merchant or a banker continue prosperous were he to invest his money in enterprises such as this? It is generally believed that in banking or in trade, none but careful, shrewd and calculating business men can count upon success. But on the other hand, "any body can run a farm." So he can if it is to be run with recklessness and utter disregard for the consequences that must inevitably ensue. The end will come and in less than sixteen years there has been thrown away the entire value of the farm.

But this is not all. These fifteen head of cattle that are turned out upon the fields during the spring, summer and fall are necessarily moving about during the day collecting their food. Each animal standing still covers with its feet half a square foot of land. If the animals step 24 inches at a stride, the 15 in walking a little more than 2¼ miles will have trampled an acre.

The damage thus done to pasturing is greatly under-estimated, vegetation is so injured by crushing as to seriously retard its growth. The tender grass plants are trodden again and again, until the pasture becomes so much injued that the cattle can no longer live on it, when they are removed and the plants that have survived are permitted to recuperate. Then the old plan over and over again. Why is it that farmers are in such haste to

remove cattle from their potato plots or gardens, if it is not that they fear the destruction of the plants that they would there cultivate ; or what farmer would permit his cattle, even were they muzzled, to run wild over his corn and wheat fields day after day, tramping into the earth the growing plants? He very well knows that he would lose his harvest by permitting such a course. Why then, if his object be to raise the greatest quantity of vegetable growth upon the soil, does he knowingly and deliberately pursue a system that involves the mangling, mutilating and destroying of plants, thus effectually preventing the very object of his profession? Does not this system necessarily tend to, and in many instances does it not actually result in making the fields as unproductive as the public road?

But the injury done is not confined to the plants alone. The soil also, if it is clay, as is the case in most parts of Centre county, is seriously injured by this practice.

Where this system is pursued cattle are turned out to pasture every day, wet and dry, in the early Spring and late in the Fall, many times when the ground is so saturated with water that the animals sink into it, two, three or four inches at every step, compacting the soil as completely as if done by a press. What is the result: 1st. No grass will grow in those foot holes, and 2d, where the land is being ploughed it will require sharper and stronger irons, a more powerful team, the draught being increased at least one-third, slower work, and the parts so tramped will break up into clods nearly as hard as stones, impervious to moisture and impenetrable by the roots of plants. Full crops cannot be grown upon such a soil, and it frequently takes years of careful tillage to restore such a field to its original condition.

By this system, also, more than one-half of all the manure made upon the farm during the year instead of being beneficial is positively injurious to the crop. The droppings have the effect of destroying the grass on the part where they fall, and also of rendering much around so distasteful as to be refused by the animals pasturing there. And the ultimate advantage is not as great as is imagined. Since much of it falling upon hill sides is washed away by floods, while that upon the level land is partly destroyed by insects or lost by evaporation.

Could these droppings be saved upon the manure heap, and placed upon the land at the proper time and in the proper places, not only would the injury be avoided, but the productiveness of the soil be greatly increased. The cattle too by lying upon the plants render them unpalatable, and when at length they are free from the odor and might be eaten, they have become so old and woody as to be refused.

The question submitted by your committee, asks, "what is the *best* that can be done under existing laws?"

Situated as we are here in Centre county, is what we are doing the *best* that can be done? Is it absolutely necessary that every farmer, living in the grain growing districts of this county, owning 180 acres of limestone land worth at least $60 per acre, shall expend annually the sum of $373 70 for fences in order that he may keep 15 head of cattle, that by this system cost annually for food alone, $310 20 more than they produce? Is this necessary? Is there not a better way, a cheaper way than this? If there is not, I submit the question to your judgment as practical thinking, careful men, would it not be far better to sell off every hoof of cattle from your farms and refuse entirely to own or keep such unprofitable, or rather such exceedingly expensive stock? It seems to me that there can be but one answer given in reply.

Let us examine and see whether there is not another and better way.

The losses that have been enumerated have occurred mainly from the expenses necesearily attendant upon the grazing of cattle. Can these expenses be lessened? If so, how? Well, 1st. The inside fences must be gotten rid of. They are all loss and no profit. This could be done were farmers to do as has been suggested. Sell off all their cattle and keep none at all during the grazing season of the year. This would not only enable the farmer to abandon his inside fences, but would at the same time cut off the other sources of loss growing out of the whole system of grazing. This, of course, would make it necessary that for part of the year the farmer would have to buy his milk and butter. If all farmers were to adopt this plan, these articles would have to be dispensed with and great discomfort be thereby occasioned. So the plan becomes impracticable, because enough butter and milk for the farmer's family is nearly a necessity and enough cows to supply this necessity are therefore needed, even should they cost somewhat more than they produce. If the figures that I have made are correct, it would follow that more cattle than enough to supply this need would only lead to greater loss. So that it would seem most advantageous to keep as *few* as the necessities of the case will permit. Three good cows will supply this want during the summer, and all the rest can be sold. A small portion of land may be fenced in for these three, and they be permitted to graze as before. This would take six acres in two divisions, or a rectangular piece 3x32 rods with a division fence, making in all 154 rods of fence which at $1 65 per rod is equal to $254 10, or only about 15 per cent. of the cost of fencing under the former method, or a saving of 85 per cent. This would be a step in the right direction. But, however great an improvement it may be upon the plan commonly pursued, still it is open to objection. Some fence yet remains and although comparatively a small amount, yet it is costing night and day, and you are also still paying more for your butter than it would cost you at the store;

besides there still continues the losses caused by the tramping of the cattle and the waste of their manure.

Cannot even this enclosure be avoided? Suppose these three cows were placed within your barn yard and supplied with plenty of nutritious food, with free access to pure fresh water, and an opportunity to get into the shade away from the heat of the sun in summer, and from the cold driving rains of the spring and fall. Suppose this were practicable, would not all their objections be fully met and the question answered? Can this be done? Is it practicable? This is the problem, that must first be solved, if we would abolish the system that has been shown to be so injurious to the land and expensive for the pocket.

Is it practicable to enclose cattle in a yard during the summer, and supply them with food? Let us see. The object the farmer has in turning his cattle out upon the pastures, is that they may secure, daily a supply, of nourishing food sufficient to sustain life, promote growth, contribute to the supply of milk and add to their quality of flesh. His object, whether he attains it or not is another question, his object in keeping cattle at all and supplying them with food is not mainly for the amusement that they afford, but that they may be a source of profit to him and thus increase his wealth. What is there to prevent this object being attained in a yard one hundred feet square as well as in a field 100 rods square? There is, of course, in the first no pasture; but whilst this is true, it does not therefore follow that there is no food. Is it necessary, in order that an animal shall exist and thrive and fulfill the conditions mentioned, that it shall get its living by cropping grass for itself?

Would it make much difference in the nutritious quality of the forage, or in its acceptability to the animal, if it were cut with a knife instead of being pulled off between teeth and gums?

Does it add much to the product of the animal to be compelled to walk miles in the hot sun or cold rain in order to appease the cravings of hunger or to satisfy its thirst? Is there any great advantage to be gained by causing animals to eat crushed and mangled grass, saturated with urine and defiled with excrement, that would not be accomplished by supplying them with plenty of fresh, sweet, nutritious, wholesome food, in a quiet, dry and cool enclosure? But some one says where shall we go to get the grass? I reply, just where the cattle get it—right out in the fields where the cattle go. The very same grass, differing only in that it is clean and sweet and free from noxious and bitter weeds.

Give it to them in their racks or mangers in the yard, morning, noon and night, fresh from the field, full of all its juices, and rich with every ounce of nourishment that it can hold. Does any one think that they will not eat it? You know that they will. Experience has demonstrated that they

will not only eat it, but will thrive and produce more milk and butter than by any system of pasturage ever yet devised. In many countries it is about the only system that is pursued. In Germany it is the common practice. In France travelers say that one can travel for days and see no fence. In the Netherlands cattle are fed in yards. In parts of England the same is practiced, and here in our own country there are numerous instances of the successful practice of keeping cattle during the summer in yards. In the Connecticut valley for part of the year cattle are soiled. In parts of New York State the same is done, whilst many dairies are conducted upon this principle in the vicinity of large cities. All statistics and experience upon the matter go to show that with plenty of green food supplied in yards, cattle will not only eat with avidity but thrive more rapidly than by any other system now in use.

But, says the objector, you cannot get green forage for your cattle as early in the spring as if they were turned out to grass, and in the fall you have nothing except dry food to feed.

To avoid this, sow rye the previous fall, and you will be able to start with green forage as early as and even with your pasturing neighbor, and by sowing a patch of corn, you can have abundance of forage for the fall until the frost appears, and after that you have the second crop of grass, and by a little care can have roots and other succulent food to feed along with drier forage. But the objector contends all this is expensive and troublesome. Let us look for a moment at the expense. By the system of pasturing, it took two acres of land to keep each cow, and in estimating the cost of keeping we supposed that each acre of pasture would produce, notwithstanding all the destruction occasioned by tramping and the other injuries involved by the system of pasturing, one ton of hay. Is there anything in this theory of tramping, or is it but a bugbear to scare the timid? By the plan proposed there could of course, be no loss from these sources named, but every spear of grass can be used for food.

Mr. Josiah Quincy writes, that for years he has kept twenty head of cows upon seventeen acres of land, that by the other system took fifty acres, and he never lacked food. Here is a saving of thirty-three acres out of fifty. Joshua St. Clair states that thirty head were soiled on seventeen and a half acres, from May 20, to October 1. (Am. F. Book, 272.) In general it has been shown that in this country half an acre to the head is sufficient for summer food, or a ratio as compared with pasturing one to four. In England the proportion is still greater, being as one to seven.

In order that we may be safe, say that the proportion is as one to four, or that half an acre will keep a cow. There would be saved three-fourths of the land employed by the other method, and this saving is due almost entirely to the plants being free from the injuries they formerly sustained.

The labor or the trouble consequent upon the adoption of this plan may be reduced to a minimum, by using plots of ground contiguous to the cattle yards, so that in a few minutes, less time indeed than it often takes to bring these cattle from the field, fresh forage can be cut and placed in the racks. Suppose the labor and trouble were far greater than by the other plan, the manure saved would amply repay it all. Taking then the figures as given in the estimates already made, what do we find?

That the three cows soiled cost as follows:

Produce on 1½ acres of land cultivated as before	$15 00
Six tons of hay during winter	60 00
Interest on three cows @ $40 00 each @ .06	7 20
18 bushels of corn @ 50 cents	9 00
Making a total cost of the said produce of	91 20
Cows produce, same as by the other plan	112 50
Leaving a net profit	21 30

per year. Not an enormous profit to be sure, but the important matter is there is no loss.

The limits of this paper forbid more than this brief and imperfect reference to this soiling process, but inquirers after more particular information are directed to consult the admirable work of the Hon. Josiah Quincy, of Mass., who probably gave the subject more careful trial and investigation than any other practical experimenter in the country.

Here then is a way, a better way, a cheaper way than the one heretofore pursued, and "there's millions in it." I have estimated from the census of 1870 that the inside fences of the farms of Centre county have actually cost more than two millions, or an amount equal to the entire products of all the farms of the county for one year, or twice as much as the value of all the live stock in the county. These fences represent a yearly cost to the farmers of the county of about five hundred thousand dollars, ($500,000) an amount nearly equal to the value of all the wheat raised in the county in one year, or the entire value of the corn crop of the county, and is equal to an annual tax of $15 00 per head upon every man, woman and child in the county. All this might be saved to go into the improvement of lands, the education of children, self culture and the promotion of christian morality throughout the land. Nature, reason and observation cry out against the old practice and every inducement that can be offered is held out to those who would try the new. New to us, but old and tried and successful in those other lands, where our wasteful system would drive farmers into the lowest poverty were they to pursue it.

Thus millions upon millions are thrown away by the farmers of this country every year for want of knowledge and for want of thought, and now to the question of your committee: "What is the best plan for Centre county farmers to pursue with reference to inside fences under existing laws?" I reply throw them out and keep your cattle in your yards.

COMMON ROADS.

PRINCIPLES INVOLVED IN THEIR CONSTRUCTION, AND METHODS FOR THEIR IMPROVEMENT.

BY E. P. AUGUR, CIVIL ENGINEER, MIDDLETOWN, CONNECTICUT.

No institutions are more necessary to the existence and well-being of a civilized community than its common roads. The correctness of this statement may not be, at first, apparent. Yet if we imagine a community having no roads, and think of the many institutions and industries which could not exist without such facilities for traffic and intercourse as only common roads afford, the assertion will no longer seem extravagant. Common roads are of fundamental importance to the social, industrial and civil institutions of any well ordered community.

It is very generally and erroneously supposed that railroads have detracted largely from the usefulness and importance which, formerly, may have belonged to common roads. Hence it is, perhaps, that the latter have been so generally underrated. No one can deny that the marvelous growth of our nation during the last half century has been largely due to railroads. They afford facilities for enormous traffic and rapid transit which, with no other means of intercourse than common roads afford, would be impossible. Railways have supplanted common roads only as main thoroughfares of traffic and travel. This is the sphere of their usefulness. To common roads still belong the more varied and general uses of the community, which constitute so large a part of social and commercial intercourse for which railways, from the great cost and other peculiarities of their construction and operation, are wholly unadapted. The introduction and use of railroads have enhanced, rather than detracted from the importance of common roads, since by means of the latter a large part of the traffic of railways must come from its sources and reach its ultimate destination. Railways depend greatly for their successful operation upon good and sufficiently numerous common roads without which as a means of traffic they would be very incomplete. They no more lessen the importance of common roads than do colleges and seminaries lessen the importance of common schools. Each have their own sphere of usefulness in the great system of social and commercial intercourse. Railways and common roads have been styled the arteries and veins of the body politic through which flow the products of agriculture and manufacture and the supplies of commerce, the life-blood of the State.

The activities of the body are mainly at its extremities, to and from which through myriads of small veins the blood must course freely or the activities become paralyzed. The activities of a commuuity are in its factories, on its farms, in its homes, to and from which supplies and products must be transported for greater or less distances over common roads. Poor roads impede the prosperity and paralyze the industries of any section where they exist; while, by improving roads within the limits of wise economy, the social and industrial interests of a community will be correspondingly advanced.

Good roads are of especial value to agricultural communities. The profits of farming depend largely upon the cost of getting produce to market. If by improving the roads double the load could be drawn, the cost of traffic over them would be reduced one-half; or the distance from which produce could be drawn with profit would be doubled. One-fourth the time now required for light traffic might be saved if our almost universally poor roads were what they should be. Vehicles and harness would be much more durable, and the vigor and usefulness of horses and cattle would be greatly prolonged.

Good roads contribute largely to the pleasures of rural life. Who does not like to ride after a good horse over a good road? To farmers this means of enjoyment may be available at slight cost. The occasional errands to the post-office or market, matters of business and necessity, should also be opportunities for pleasure and recreation. Good roads would tend to make them such.

Improving the roads would promote and increase the social advantages of country life. The families of farmers have far too little intercourse one with another. That this is somewhat due to poor roads can hardly be doubted. At the seasons when farmers have most leisure, the roads, for much of the time, are either so muddy or so rough as to discourage any inclination for visiting at each other's homes. When the roads are best, the time and energies of farmers and their families are too much absorbed in the labors of the farm to admit of much social intercourse.

Bad roads occasion much of the injury and abuse of horses and cattle. A team is often injured more by being "set" in some slough of the road, than by all the ordinary work of a whole season. The frequent brutality of teamsters under such circumstances justly merits the indignation of every one, and the penalty of the law. Good roads would prevent much of such injury and abuse.

Under the various systems of road management existing in this State, farmers are, to a great extent, the makers and repairers of common roads. It therefore devolves on farmers, as *road-makers*, to know how to use the public funds appropriated for the maintenance of the roads, so as to secure,

in the highest degree possible, the ease of traffic, and the speed and pleasure of travel. It certainly devolves on farmers, as *citizens*, whatever system of road management may exist, to understand the simpler principles upon which the proper construction of roads depend, that they may act intelligently with reference to methods and expenditures for their maintenance and improvement. Farmers, of all others, should take deep interest in and encourage the improvement of common roads, since upon the existence of good roads their success and happiness so largely depend.

Having thus briefly alluded to the general importance of common roads, and to the relations and responsibilities of farmers concerning them, let us proceed to consider the principal forces which oppose traction on roads, and under what conditions they present the least resistance.

The resistance to traction upon roads, results mainly from two natural forces, GRAVITY and FRICTION. GRAVITY *opposes* forward motion on *rising* grades, and *causes*, or *aids* to cause, forward motion on *falling* grades, while on level grades it does neither. FRICTION is a *constantly opposing* force. To overcome the resistance of one or both of these forces, and produce motion, another force is applied, called DRAFT. The DRAFT applied must always equal, or, strictly speaking, it must slightly exceed the resistance of the opposing force, or forces before a vehicle will move along. GRAVITY and FRICTION act spontaneously in obedience to natural laws. Draft, on common roads, is at present the muscular force of horses and cattle. Draft, therefore, involves a twofold cost: First, for the animals exerting it, and secondly, for their equipment and keeping. Hence, the less the draft required on any road for a given amount of traffic, or, which is the same thing, the less the resistance of *gravity* and *friction*, the less the cost of traffic over the road.

In the construction or improvement of a road, the aim should be to make the resistance of these opposing forces as small and as nearly uniform throughout its length, under the varying conditions of climate as is possible within the limits of reasonable cost. Let us consider the forces already mentioned more particularly, that we may ascertain how roads should be constructed with reference to them.

Gravity tends to draw all bodies toward the earth's centre. This is the force which makes a cart or wagon roll down hill of itself, or which necessitates a holding-back force, or the use of brakes in descending steep hills with heavy loads. Gravity also occasions the extra draft required to move a load up a hill. The amount of its resistance may be accurately determined when the rise of the grade and the weight of the vehicle and its load are known, it being always such a proportion of the weight as is the rise from level of the length of road surface in which the rise occurs. The

following figure (Fig. 1) represents a vehicle, which with its load weighs one ton, standing upon a grade of ten feet rise in one hundred feet, meas-

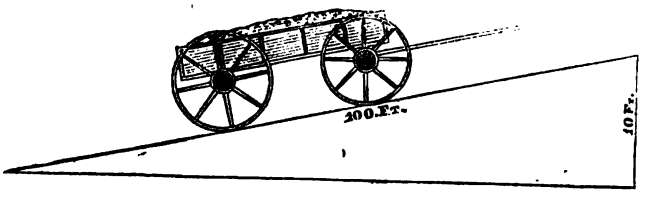


FIG. 1.

ured on the road surface. To move the vehicle up the hill, a draft force of two hundred pounds, equal to one-tenth of the weight of the load, must be applied to overcome the resistance of gravity alone, besides an additional amount of draft required to overcome the resistance of friction. If we suppose the vehicle to be moved *down* the hill, gravity tends to *produce* motion with the same force of two hundred pounds or one-tenth the weight.

If we suppose the same vehicle to stand upon a road of *five* feet rise in one hundred feet measured upon the surface, gravity will act with a force equal to five one-hundredths of the weight, or one hundred lbs., to oppose or cause motion according to the direction in which the vehicle is moved.

The resistance of gravity is the same on all roads of similar grades regardless of the character or condition of their surfaces. The wide difference in the draft required for the same load on different road surfaces of similar grade is due to the other opposing force, *friction*, which will be subsequently considered.

Gravity opposes or aids traction on every road the surface of which rises or falls from level. Its resistance on any given road depends *absolutely* upon the total number of feet of rise and fall throughout, and *relatively* upon the steepness of its grades.

The resistance of gravity on any road can be lessened only by improving its grades. This may be accomplished by cutting down the summits and too high portions of the road, and filling its depressions, or by changing the lay-out so as to secure more favorable natural grades. On existing roads the former course is most practicable unless the lay-out is a very faulty one in this respect.

Grading wisely done, lessens the *absolute* resistance of gravity by lessening the total number of vertical feet of rise or fall, up and down which loads must be drawn. It also lessens the *relative* resistance of gravity by lessening the rate of inclination of excessively steep grades, and by mak-

ing the necessary rise between two fixed points as nearly uniform as possible throughout.

Roads should never ascend or descend a single foot more than is absolutely necessary. In the ascent of a hill not even the smallest descent should be allowed, if it can be reasonably avoided, as it would increase both the actual rise and the steepness of the hill. Nearly all the roads in sections of the State which are hilly, are more or less faulty as to grades. They might be greatly improved under the direction of a skillful engineer or road-maker at moderate cost.

Prof. Gillespie, in his excellent treatise on "Roads and Railroads," gives the following forcible instances which show how greatly roads may be improved as to grades. A new road built by Telford, in Anglesea, saved twelve hundred and eighty-three vertical feet of rise and fall, or about one-third of the rise and fall on the old road, while the distance between the two places was reduced from twenty-four miles to twenty-two.

On a new road built some years since between Cazenovia and Chittenango, New York, the whole perpendicular rise and fall was only eight hundred feet, the actual difference of level between the two places; whereas the most level road previously connecting them rose twelve hundred feet, and fell four hundred feet, in going from the lower place to the higher. Loads drawn from one place to the other in either direction over the old road, had to rise and fall four hundred vertical feet which by the new road is wholly avoided. The steepest grade on the new road was 1 in 16½ or about 6 in 100.

On the famous Holyhead road built by Telford over the mountainous country of North Wales, there were but two grades steeper than 1 in 30, one of 1 in 22, and another shorter grade of 1 in 17. On the previously existing road the grades had frequently been as steep as 1 in 10, or 1 in 8.

Figure 2 represents the profile of a portion of the principal road between the cities of Middletown and Meriden, Ct. The irregular line represents the present road surface. The connected straight lines show a proposed improvement of the grades. In going from A to B, the present road rises one hundred and six and one-half feet, and falls thirty-six and seven-tenths feet, in the thirty-one hundred feet of distance shown. The proposed grade rises in the same direction eighty and eight-tenths feet, and falls eleven feet. On the road as it is, the steepest grade is 12 in 100. By the proposed grade line, the steepest rise would be only 5 in 100. The deepest cutting necessary to effect these results is only fourteen feet, and the deepest filling eight feet. The proposed grade therefore lessens the *absolute* resistance of gravity one-fourth, and lessens the *relative* resistance of gravity on the steepest grade seven-twelfths.

Your attention is called, just here, to a very common and serious obstacle to traffic on common roads, namely "water bars" or "breaks," as they are termed. However well made they add to both the total rise and steepness of the road.

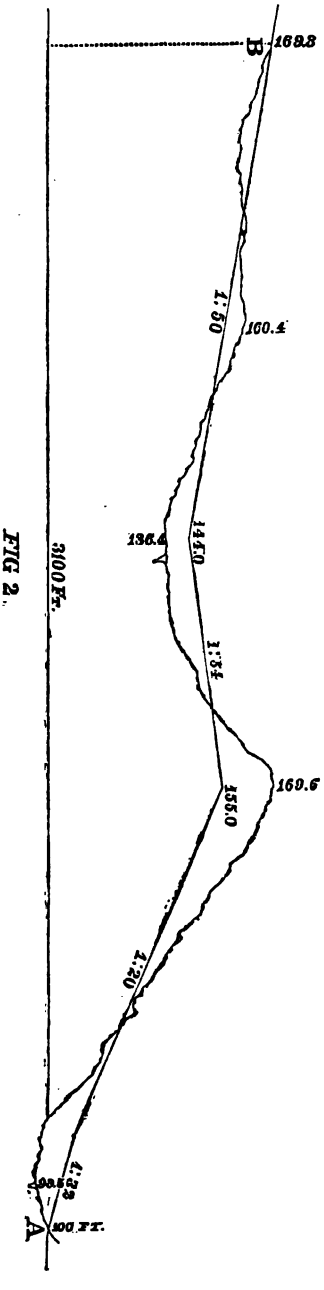


FIG 2.

Figure 3 will illustrate the increased resistance of gravity which results from the use of bars. The line A B represents a portion of a hill which, without any bars, has a uniform grade of 1 in 10, measured on the surface. The uniform resistance of gravity for each ton of load is two hundred lbs. Suppose six bars to be built as represented, the summit of each being nine inches higher than the previous grade vertically beneath it, and six inches higher than the upper foot of the bar; the length of the lower slope of the bars being fifteen feet. These six bars add three feet to the total rise of the hill, or $\frac{3}{100}$th of its previous vertical rise. They also increase the steepness of those portions of the hill on which they are made, nine inches in fifteen feet, or 1 in 20. Hence they occasion an extra resistance of gravity equal to $\frac{1}{200}$th the weight of the vehicle and its load, or one hundred lbs. for each ton. Three hundred lbs. of draft per ton will be required to overcome the resistance of gravity alone on the ninety feet of bars—nearly one-fourth the whole length of the hill, whereas without bars the resistance of gravity was only two hundred lbs. Besides thus increasing the resistance of gravity, bars occasion much strain and wear of vehicles and harness, to say nothing of the discomfort of riding over them.

The bars we have supposed are not as steep, or as faulty in other respects, as the majority of the bars on our common roads. It must be borne in mind that in the figure their height is exaggerated about five-fold, to make them more apparent to the eye. Bars are commonly constructed as shown in figure 4; and the extra draft they necessitate is greater than has been already shown. That bars may occasion the least possible extra draft, they should not be unnecessarily high, and the road should slope uniformly

from the summit of one bar to the upper foot of the next below. Were roads what they should be as to grades, surfaces and drainage, bars would

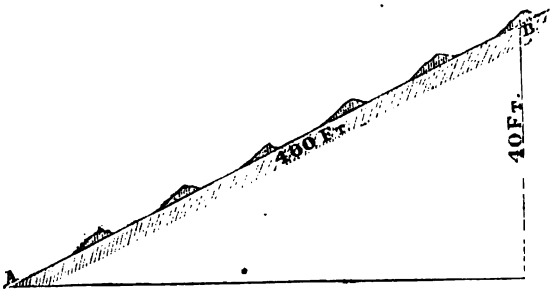


FIG. 3.

seldom, if ever, be required. Their use should be much less frequent, and their construction quite different than it is, even with the roads in their present condition.

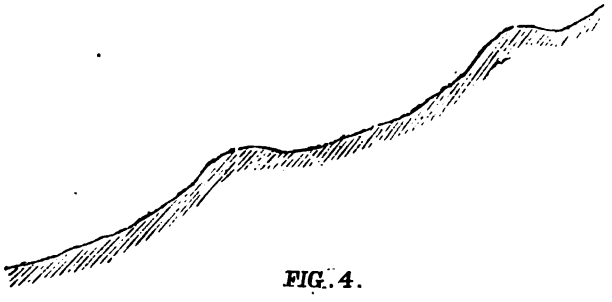


FIG. 4.

The disadvantage of steep grades is even greater than has thus far appeared. According to Emmerson's mechanics, a horse though as strong as five men on a level road, owing to his peculiar structure, on very steep hills has hardly the strength of three men. Gillespie gives the following table deduced from numerous experiments. Calling the load a horse can draw on a level 1.00, on a grade of

1	in	100	he	can draw	0.90
1	"	50	"	" "	0.81
1	"	44	"	" "	0.75
1	"	40	"	" "	0.72
1	"	30	"	" "	0.64
1	"	26	"	" "	0.54
1	"	24	"	" "	0.50
1	"	20	"	" "	0.40
1	"	10	"	" "	0.25

Roads of steep grades are likely to be badly washed by the too great velocity of water in running down their surfaces. They are also dangerous

to travel when covered with ice. A steep grade is especially objectionable when it occurs in a long line of road otherwise comparatively level, because the load for the entire road must be limited to what can be drawn up the steep ascent. If a long grade of 1 in 10 occurs on a road having no other grades steeper than 1 in 30, the load must be limited to less than half what can be drawn up the ordinary grades.

Every road should be perfectly level, gravity alone considered, because only such grades wholly eliminate its resistance. This conclusion is somewhat modified, however, by one or more of the following considerations. First, the proper drainage of water from the road surface requires that it should slope slightly both longitudinally and transversely. Secondly, two places are generally at different elevations, in which case the road connecting them could not be of level grade throughout. Thirdly, road improvements are limited by their cost. In sections at all hilly, roads could not be made level or of uniform inclination without far exceeding the limit of reasonable cost. These considerations suggest the importance of determining the proper limits within which, as a general rule, grades should be chosen.

The slope needed to secure proper drainage, where the road could as well be made level, involves a slight resistance of gravity otherwise unnecessary. Hence the minimum slope should be no greater than is required for the purpose it is to serve. An experienced English engineer has assumed 1 in 80, or sixty-six feet per mile as the proper minimum grade, while the French government board of engineers of roads and bridges, established for their roads a minimum grade of 1 in 125, or forty-two feet per mile. The more perfect the surface the less the grade required to afford drainage. It may be assumed that roads should never have a grade less than 1 in 125.

The steepest grade of roads should not exceed what is termed the "angle of repose." On such a grade the force of *gravity* to cause motion, is just balanced by the force of *friction* to oppose it. On such a grade a wagon or cart will stand at rest. Heavy loads may be drawn down such grades without crowding upon the horses. Accidents would occur less frequently and would be less serious, if roads were no steeper than this.

In ascending such a grade, gravity and friction both oppose traction with equal force, and the draft is just double that required on a level grade. Horses are capable of exerting double their ordinary working power for a moderate length of time, and for a shorter time even more than that. We may therefore assume the grade which equals the angle of repose as the *maximum* grade of roads. Grades which must be steeper, should be considered exceptions to the rule. The maximum grade on loose gravel roads

is about 1 in 16; on common earth roads in good condition, about 1 in 20; on the best Telford road about 1 in 50.

Gravity indirectly opposes traffic on roads of much convexity or cross-slope, by tending to make the vehicle slide sidewise towards the gutter. The vehicle is usually kept in its proper place by an extra amount of friction between the wheels and the road surface, which thus adds somewhat to the draft required. This tendency of gravity on the sloping sides of roads is seen when they are covered with ice, in the slewing of vehicles upon them. Roads should have no more transverse slope than is requisite for good drainage.

The best cross section for a road is one formed by two planes rising slightly from the sides toward the center, connected by a slight curve as shown by figure 5.

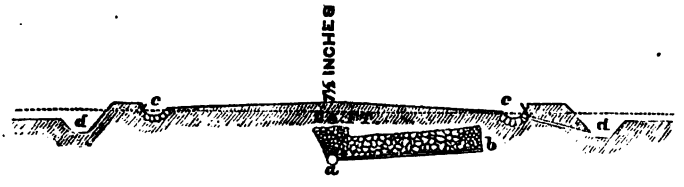


FIG. 5.

The cross-slope of earth roads should seldom exceed 1 in 20. Telford adopted for broken-stone roads a slope of 1 in 30. M'Adam gave to his roads a cross-slope of 1 in 36, and in some cases only 1 in 60.

The cross section most generally adopted among our roadmakers conforms nearly to the segment of a circle, or a flat semi-ellipse. It is generally supposed that rounding up the road in this way secures good drainage. It will be seen, however, that drainage alone considered, this form is objectionable. Even with this extreme roundness, the centre of the road is too flat to allow the water to run off properly, while the sides are so steep as

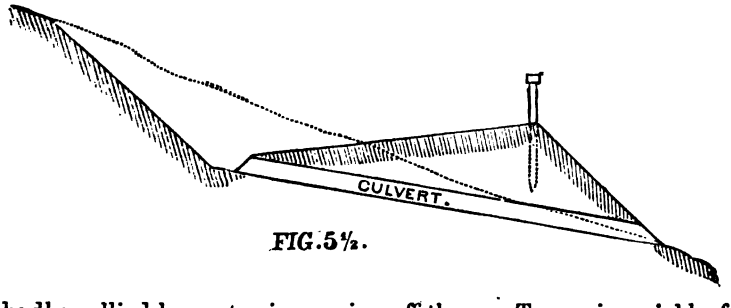


FIG. 5½.

to be badly gullied by water in running off them. Teams invariably follow the summit of such a road, the sides being unsafe and uncomfortable to ride upon. This depresses still more the already too flat part of the road, so

that the water falling on the centre of the road must run along the tracks of the wheels and horses until turned off by bars or other means into the

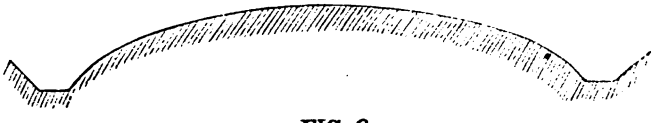


FIG.6.

gutters. Much of the damage of roads by water is the consequence of a faulty construction as regards their cross-section. If roads slope moderately and uniformly toward the gutters, water will drain off properly from the entire surface without any considerable damage to the road. Teams travel with equal ease and safety on every part of such a road. Travel may be uniformly distributed over the whole surface of the road, which would prevent the forming of ruts and consequently much of the damage caused by water. As to drainage therefore, extreme convexity defeats the very purpose it is supposed to serve.

On a convex road nearly all the wear of travel, as we have already seen, is borne by three narrow portions of the road, the tracks of the wheels and horses, in all not more than one-fourth or one-third the width of the roadway proper. The rest of the road is practically useless, except that it affords room for teams to pass each other, and for turning about. Such roads require much more frequent and extensive repairs than roads of moderate and uniform cross-slopes, owing to the unequal wear of their surfaces by travel.

Thus far we have considered the force of *gravity* as it affects traction on common roads, and what the grades and cross-section of the latter should be with reference to the same in connection with drainage and other considerations. Let us now consider somewhat briefly the other opposing force.

FRICTION.

The resistance of *gravity*, as we have seen, depends entirely upon the inclination of the road regardless of the kind or condition of its surface. The resistance of *friction*, on the contrary, depends upon the character and state of the road surface, independently of its grades. The friction which opposes traction is generated partly at the axles, but mainly between the rims of the wheels and the road. It will be herein considered as occasioned entirely by the road surface.

Friction is caused by the wheels bearing upon and displacing the particles of the road surface, and by these particles rubbing against and displacing others, and so on. The more the particles of the road surface are displaced and the harder they rub against each other, the greater the fric-

tion produced. Hence roads to present the least frictional resistance to traction should be as permanently hard and smooth, under the varying conditions of traffic and climate, as is possible.

Many excellent kinds of road surface are now in use, the principal of which are stone trackways, stone pavements, wooden pavements, asphalt and concrete pavements, broken stone surfaces and gravel surfaces, all of which, except the last two kinds, are too costly for country roads.

The resistance of friction is too variable to be mathematically determined. It may be found for any road by measuring the draft required on a *level grade* with a dynamometer, the instrument used for testing the draft of mowing machines; or by finding by experiment the grade equal to the "angle of repose," from which we may calculate the resistance of *gravity*, to which on such a grade the resistance of *friction* is always equal. The mean result of several experiments on any particular kind of road will show with sufficient accuracy for practical purposes the frictional resistance of such a road surface. The following table, taken from Gillespie's "Roads and Railroads," gives the frictional resistance of each of the various road surfaces named, obtained from experiments made with a dynamometer, the load in each case weighing, including the vehicle used, twenty-one hundred pounds:

	draft.	
On a gravel road laid on earth,	147 lbs.	$= \frac{1}{16}$ weight of load.
On a broken stone road on earth,	65 "	$= \frac{1}{36}$ " "
On a broken stone road on paved bottom	46 "	$= \frac{1}{51}$ " "
On a well made pavement	33 "	$= \frac{1}{71}$ " "
On a best stone trackway, per gross ton	12½ "	$= \frac{1}{179}$ " "
On a best steel railway	8 "	$= \frac{1}{280}$ " "

Broken stone roads are of two kinds, named respectively from the engineers who devised and introduced them, M'Adam and Telford roads. Their main difference consists in a pavement of rough stones beneath the broken stone surface of the Telford road.

The stone for the surface of either should be both hard and tough, and should be broken so as to pass through a ring two and one-half inches in diameter. Basaltic or trap rocks are the best; sienite or granite next; limestones next. Sand stones, if soft, and clayey stones should never be used for roads. The thickness of a M'Adam road, which is made wholly of broken stone, should be from six to twelve inches, according to the amount of traffic, and the nature of the road-bed. The road should be first suitably graded and properly arranged to secure good drainage, after which the stone may be applied in layers not exceeding three inches in thickness.

Each layer should be somewhat compacted with a heavy roller, or by travel, before the succeeding layer is applied.

Figure 7 represents the section of a M'Adam road.

The Telford road consists of a pavement of rough stones set on their boardest edges or ends, lengthwise across the street. The thickness of this

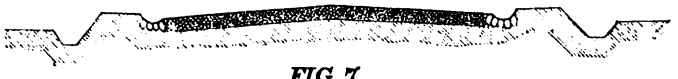


FIG. 7.
M'ADAM ROAD.

pavement should be from seven to nine inches at the centre, and from three to six inches at the sides. Fragments from hard stone should be wedged into the openings on the top of the pavement, with a light hammer, after which the tops of stones projecting above the general surface should be broken off. The broken stone may then be applied as on the M'Adam road, but need not be as thick, six inches being ample for country roads.

Figure 8 shows the section of a Telford road.

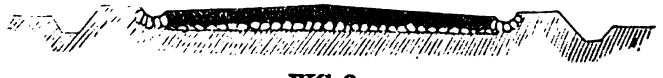


FIG. 8.
TELFORD ROAD.

Of the two, Telford roads are generally considered by engineers and intelligent road-makers the better. The Telford pavement makes a firmer and more durable road, and prevents the earth beneath, softened by receding frosts or otherwise, from pressing up among the broken stone. It also affords a kind of under-drainage, and allows the use of larger and less expensive stone in the bottom of the road.

The leading principles regarding broken stone road surfaces are: First, that stone must be somewhat broken into angular fragments before they can be firmly compacted together; secondly, that only small stone should be used near the surface of the road, as the force of wheels or the hoofs of horses striking eccentrically upon a large stone would loosen it, and the smaller stones about it from their places, thus preventing the road from becoming solidly compacted together.

A Telford road twenty-five feet wide, properly constructed, would cost from twelve to twenty dollars per rod, unless the stone were near at hand, and somewhat broken. This comparatively large cost will prevent their being brought at once into extensive use for country roads. The Telford road may be used with great advantage for those portions of highways which are frequently sloughy and difficult, even before they are adopted for extensive use, on long sections of roads. Since broken stone roads are necessarily quite expensive, no thoroughness should be wanting in their construction. The maxim, "What is worth doing at all is worth doing well," is especially true in the construction of broken stone roads.

The most perfectly constructed gravel roads are made by applying screened gravel upon the natural surface, after having first made suitable provision for under-drainage. The gravel should be applied in layers one or two inches thick, each layer being thoroughly imbedded by a heavy roller before the next is applied. The use of a heavy roller in constructing and repairing common earth roads would promote both the durability of the roads, and the ease and comfort of travel.

The gravel generally used on roads has too great a mixture of sand and earth in it to produce the best results. The poorest gravel is much better, however, than the clods, soil and worn-out material, which are so universally and indiscriminately scraped upon the road from the gutters. Gravel should be used much more extensively in repairing roads, especially in sections where it is abundant and of good quality, until roads of better material can be afforded.

The resistance of friction on a road is greatly increased, and its durability much impaired by excessive moisture. This is especially true of roads of natural earth surface. Some means of preventing, and of removing, any excess of water are of great importance, especially where the earth is of a clayey nature, or otherwise retentive of moisture.

We have already fixed upon the slopes roads should have, that water may drain readily from their surfaces. There should also be suitable gutters and ditches at the sides of the road, to conduct away the water which runs off its surface. The road should, at the same time, be so constructed that no water can possibly run upon it from the roadsides or adjoining fields.

On most of the roads of our State the gutters and side ditches are one and the same thing. Most road-makers seem to regard them merely as pits from which the material for road repairs is to be taken. Often the stones and rubbish culled out in leveling off the road are thrown right back again into the gutters, there to remain until again scraped upon the road.

It is seldom that any pains are taken to leave the gutters well cleaned out, with a good descent so that water will flow along them freely. They are frequently left as pond holes, which collect and hold the water that drains off the road, until it becomes absorbed by the ground beneath it and at its sides. The gutters should always be kept unobstructed, and, at moderate distances apart there should be open ditches leading from them into the fields, or otherwise away from the side of the road.

If the surface of any road is to be thoroughly and systematically improved, such an arrangement of gutters and side ditches as is shown in figures 5, 7 and 8 is recommended. On each side of the road-way is a shallow gutter, paved with hard, roundish stones. Outside each gutter is a mound, or shoulder, from four to six feet wide, about eight inches higher

than, and sloping slightly toward the gutter. At the foot of the outer slope of each mound is a side ditch of sufficient size and fall to carry off readily all the water it may receive. At distances apart of two or three hundred feet, channels or culverts should be made across the mounds to lead the water from the gutters into the side ditches, which should be paved, or otherwise protected from being injured by the water. One of these mounds may be graveled, for a foot-path, while the other will afford storage room for broken stone or gravel, for use upon the road. They also keep the water from running over the gutters and gullying the side-slopes of the road, and serve as a guard against driving off the road at night. They protect the road somewhat from severe frosts, and on Telford or M'Adam roads, make firm shoulders against which the broken stone may rest.

The surfaces of roads should be raised at least fifteen inches above the level of the ground at the sides, and should be not less than two and one-half feet above the bottom of the gutters. This would facilitate drainage, and prevent water from the road-sides from running upon and along the roads when the gutters become obstructed with snow and ice. Roads thus raised would be more favorably exposed to the action of the sun and wind, and would sooner become dry after rains and thaws.

Good culverts should be built where the road is crossed by small streams, and where otherwise water would sometimes collect on the upper side of the road. These should always be sufficiently deep, and of ample size, to afford a ready passage for all the water of the heaviest rains. They are usually made by laying two paralled walls of stone and covering them with heavy, flat stones or plank. They are seldom properly constructed, and in most cases require building over every three or four years.

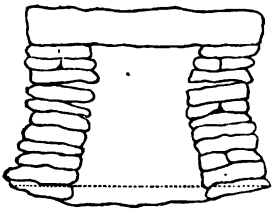


FIG. 9.

Figure 9 represents the cross-section of a culvert, showing the results of faculty construction.

Figure 10 represents the cross-section of a similar culvert properly built. If the bottom of the culvert is of earth, the water will after a time undermine the walls, causing them to settle and fall inward. If the walls are light and of too small stone, the frosts pressing against them from behind will have the same tendency to overturn them toward the centre of the cul-

vert. The bottoms of culverts should be paved, as in figure 10, or protected in some other equally good way. Their side walls should be of solid,

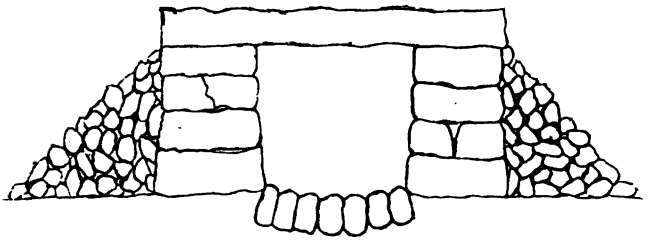


FIG.10.

good-sized stone, and never less than two feet thick. If liable to injury from frost, a backing of field stone should be placed behind the walls, as shown in the figure. If the covering is of large, flat stones, they should be cramped together with irons, or two courses of stone should be used, breaking joints with each other. Plank are objectionable as a covering for culverts. Where large, flat stone cannot be easily obtained, the culverts may be arched with brick or stone. A very good culvert for a small stream is made by building a semi-circular arch of brick-work, of three feet diameter, upon two rows of solid footing stones, and paving the bottom as in figure 10.

In no way can roads on naturally wet, heavy soil, be so greatly improved at moderate cost as by under-drainage. This is best effected by laying a drain of stone and tile, or of stone alone, along the center of the road, as represented in cross-section on figure 5, at *a*. If the road is very wide, or if the ground is very wet or springy, branch drains should be laid at an angle with the main drain, of about seventy-five degrees. (The longitudinal section of such a drain is shown by *a*, *b*, in figure 5.) Drains for roads should be somewhat differently constructed than for agricultural purposes, owing to the compactness of the road-bed, and the importance of removing the water as speedily as possible. The drains should have a good descent, and should discharge into culverts, or at some sufficiently low point outside the road. There are a few other considerations relating to the previously mentioned forces in common, or not belonging properly to either, to two or three of which we will briefly allude.

Roads should never be unnecessarily long. Every foot of needless length involves a three-fold waste: First, of original cost, secondly, of expense for repairs; and, thirdly, of time and labor required in traveling over it. The chief end to be sought in road making, as has previously been stated, is the least possible resistance to traction, rather than shortness of distance. It should also be borne in mind that the length of a road is the length measured upon its surface, and not the horizontal distance between its ends.

These facts seem not to have occurred to the persons under whose direction our existing roads were projected. They have generally been laid out in straight lines, regardless of hills. The ancient Romans so built their otherwise excellent roads, traces of which still remain. Every one knows that a bail is no longer when it lies on the edge of a pail than when it stands upright, and that the distance around a hemisphere, between two opposite points, is no greater than the distance over it; but few persons see the force of these facts with reference to roads. A road around a hill is sometimes no longer than one over its summit, while the length of the former seldom exceeds that of the latter as greatly as might be supposed. How much the length of a road may be increased, to avoid a vertical foot of rise, depends mainly upon the character and amount of traffic over it, and upon the frictional resistance of its surface. As a general rule the length of roads which are to have considerable traffic may be increased twenty feet, and roads of ordinary use, ten feet, for every vertical foot of rise that can be thus avoided. A road around a hill should usually be laid out in such curves that the proper grade for the centre line of the road shall lie approximately in the surface of the ground, instead of being in straight courses. Roads on hillsides should be of such a cross section as is shown in figure 5½.

A road should not be *necessarily wide*, as every needless foot of width adds nearly one-eighth of an acre per mile to its area, and increases proportionately its original cost, besides adding somewhat to the expense of keeping it in repair. Outside of cities and villages, twenty-five feet is sufficient for the width of roads of the most traffic. Roads of ordinary travel should be about twenty feet wide. For others of still less travel, fifteen feet is ample width.

Whether any proposed roadway improvement should be made or not depends finally upon the ratio between the annual interest of its cost, and the yearly benefit to traffic to result therefrom. When such benefit exceeds the interest of the cost, the proposed improvement may be made. If the annual benefit to be derived from any proposed improvement of the road is less than the interest of its cost, the improvement should be made less extensive, until the benefit to result from it will exceed the interest of its cost. If this cannot be done the plan must be abandoned. Great care should be exercised to guard against any error which would result from prejudice in favor of the improvement. If any doubts exist the advantage of the doubt should be against making the improvement, that the estimate may be relied upon if in its favor.

A few brief suggestions will be made, in conclusion, as to the measures to be adopted for the improvement of roads.

And first, the system of maintaining the roads by a highway tax, to be worked out under the direction of a "highway surveyor," should at once

be discontinued, and some better method adopted. Better material should be used on roads, and repairs should be made in a more perfect manner. Extensive repairs should never be made late in the season. Abrupt irregularities of grade, and sudden deviations from the general course of the road should be avoided and corrected, as far as possible, in making repairs. A heavy roller should be used in constructing and repairing roads. Such an instrument would make the road much harder and smoother, and much more durable. Wet pieces of road should be thoroughly drained. Roads should receive more careful attention before and during heavy rains and thaws, that damage by water may be prevented. "A stitch in time saves nine."

Secondly: Towns should also expend something each year for permanent roadway improvements. The amount thus annually expended need not be large. As a rule improvements should be made no faster than they can be paid for by a reasonable rate of taxation. A difficult hill may be graded one year. A wet and miry piece of road may be drained and Telfordized, or otherwise improved the next year, and so on. The most difficult sections of the most traveled roads should be improved first. The improvement of sections here and there on a road, should always be made in conformity to some advantageous and well-considered plan for the whole. No part of the road should be Telfordized or M'Adamized until its surface has been properly graded, as considered by itself and with reference to adjoining sections.

Every intelligent citizen who appreciates the advantages of good roads, should encourage roadway improvements. Let a leading farmer enlist his neighbors for two or three days work with men and teams in grading some difficult hill, or in draining and otherwise improving some miry piece of road. Such an effort will do much toward awakening an interest in such improvements. The clergyman, the doctor, the lawyer and other men of culture and influence, owe it to their fellow-townsmen whose advantages for acquiring knowledge have been more limited than their own, to inform them, as they may have opportunity, concerning the principles of science which have to do with their daily avocations, their health and the institutions upon which their welfare and happiness depend. It is the duty of such persons to interest themselves in the common roads. The town, as a political unit, is ordinarily responsible for but two things—the care of its poor and the maintenance and improvement of its roads. The system by which roads are repaired and the measures taken for their permanent improvement, really depend upon a few of the more intelligent and influential citizens of the town. The ladies may do much to encourage and promote the improvement of roads. In several towns and villages of this State the ladies are organized and working to raise funds for building

walks, planting trees and erecting lights upon the streets. Let them also stir up their husbands and brothers to do something to improve the roads.

Agricultural societies should also recognize the importance of improving the roads. Let them offer a premium of a few dollars' worth of books on road-making, or some kindred subject, to the town keeping its roads in the most perfect repair during the year; also, to the town making the greatest amount of permanent improvement on its roads, and the like. This would be perfectly consistent with their partiality for the horse.

The press should also give subjects concerning roads a generous place in its columns, especially if its issues have a large circulation in country towns. If its aim is to enlighten and instruct its readers, it can find few subjects concerning which there is a more general lack of information at present than this.

The great need, to begin with, is a better appreciation of the value and importance of good roads; of the defective condition of the roads which now exist, and of the great advantages which would result from the judicious expenditure of a moderate amount of money every year, for permanent roadway improvements.

Mr. N. HART. I would like to inquire whether the height of the wheel makes any difference in the amount of friction to be overcome?

Mr. AUGUR. It does. The higher the wheels are, within certain limits, the less friction there will be; or rather, it makes no difference in the friction, but the leverage is increased, and the friction is more easily overcome. When the line of draft becomes parallel with the road surface, it is a disadvantage to raise the wheels any higher. Where the fore wheels of the wagon are so low that the line of draft is very much out of parallel with the level or the grade of the road, the horse has to lift a certain portion of the weight that rests upon the fore wheels, in addition to moving it, so that, with such vehicles, it is better that the load should be over the hind axle-tree.

Mr. SEDGWICK, of Cornwall. Does the size of the axle make any difference?

Mr. AUGUR. Yes, sir. There will be less friction on a small axle than on a large one.

Mr. MOORE. I would inquire whether the plans shown are designed for double roads?

Mr. AUGUR. They are designed for roads twenty-five feet wide, which would allow at least three vehicles to run abreast.

Mr. MOORE. Do you mean to have a track on each side of the center?

Mr. AUGUR. I recommend that there be no particular track at all. Every precaution should be taken to have every part of the road, as nearly as possible, equally travelled; and that is the reason why it is better to have some

man employed on the road all the year round, so that he may, every time he finds the road working into ruts, go and fill them up, and make them just as high as the other parts of the road, and thus divert the travel to some other part. There should be no ruts at all. A good road should be travelled equally over all its parts.

Mr. CHEEVER. What would you say about the width of tire for heavy loads?

Mr. AUGUR. On common earth roads, or on level roads, where the road is compressible, the width of the tire should be increased beyond what it is now. The friction would be lessened about in proportion as you make the tire of the wheel wider. That is, if you have a tire two inches wide, with a draft, for instance, of five hundred pounds to a ton, if you make it four inches wide, the friction will be only about one-half.

Mr. N. HART. Would you not have a greater resistance, which would be as deleterious as the greater amount of friction you got with the narrower tire?

Mr. AUGUR. Let me refer to an authority on this subject. I will read a paragraph from Gillespie on "Roads and Railroads:" "The imperfect surface of an earth road makes it doubly important to take every precaution to lessen the friction of vehicles upon it. The resistance decreases as the breadth of the tire increases, on compressible roads, as earth, sand, gravel, etc., while on paved and broken stone roads the resistance is entirely independent of the breadth of the tire."

Mr. H. B. PECK, of Northfield. Is there any advantage in having a brake attached to the wagon, applied back of the hind wheels?

Mr. AUGUR. I do not think of any advantage in it now. The action of the brake in easing loads down hill, is simply this: it increases the friction of the vehicle or of the road. Now, if the brake holds the wheel fast, then the friction at the road surface is increased. If, however, the wheel rolls round on the brake, the friction is more between the wheel and the brake. The leverage being the same, I see no practical advantage in placing the brake behind, unless it is to lessen the strain on the vehicle.

Mr. H. B. PECK. Is the weight on the axle relieved by having the brake behind?

Mr. AUGUR. No, sir, I think not. It would be a good deal like a man attempting to lift himself by his boot-straps. I am not quite positive as to that, but I think there would be no less weight on the axle.

Mr. GOLD. One of the questions in the box is about roads: "Can any better method be devised to turn water off of the roads running over steep hills than 'Indian graves,' as they are sometimes called, or water bars, or ridges extending across the road?" We get a new name for these things here.

Mr. AUGUR. I am very glad that question has been asked, because I am afraid in making up my paper, I neglected to say as much on that subject as I should like to have said. I think I said I would try to show that bars were nearly, if not wholly, unnecessary on roads. If the surface of a road is made with a uniform slope from the crown towards the gutters, and if the slope of the road can be perfectly preserved, the water will run off on each side from the centre of the road. But if ruts are worn in the centre of the road, the water will run in those ruts. If you can prevent ruts being formed, there will be no occasion for any bars at all. Very often bars are constructed square across the road; in other cases, the bars are made obliquely across; both of which forms are very objectionable. On the latter, one wheel strikes the bar and rises before the other, and the tendency is to throw the weight on the opposite side. About the time that wheel gets over the bar, the other wheel strikes it, altogether causing great strain. By the way, the strain from bars causes three-quarters of the breaking of bolts and whiffletrees and traces that occurs. First, the momentum of the vehicle is suddenly checked, and, as the horse keeps going, the bolt, or the whiffletree, or something else breaks. The better way would be to make the bar in the form of an inverted V, just as slight as possible. It should be of stone, or something of that sort, so that when heavy vehicles are going over it, they shall not cut channels through it. If you make a bar, make it of stone or cover it with good hard gravel. If you cannot stone the whole road, it will pay to stone a little piece here and there, for the sake of turning the water off.

Mr. GOLD. The question has been asked me whether bars could not be made of stone on our common roads. Two weeks ago I was at Haverhill, in Massachusetts, and visited the farm of Dr. Nichols, the editor of the *Journal of Chemistry*. He reaches his country seat by a road which ascends a long hill, as steep as any of our New England hills, and I noticed that there were no bars, in the shape in which we make them, upon that road. But there were hollows, laid with stone, shaped like an inverted V, for the purpose of turning the water off. The two wheels of the wagon, if driven in the middle of the road, would strike in this semi-hollow at the same time, and would not rack the wagon at all, and yet these hollows seemed to answer the purpose admirably. I brought home a new idea, and calculate to put it in practice. They were laid with cobble-stone, some half dozen inches in diameter. A slight depression, laid with stone, instead of an elevation, and it seemed in that case, to be answering an excellent purpose.

Mr. RICHARD GOODMAN, of Lenox, Mass. How deep were they laid?

Mr. GOLD. A few inches only below the grade.

Mr. HIRAM SAGE, of Colebrook. In making bars, do not folks ruin their calculations sometimes by not filling up sufficiently below, making them too steep to pass over comfortably?

Mr. AUGUR. Undoubtedly. The best way to make them, if they must be made at all, would be to make them incline from one bar to the foot of the next one. But on a good road, even of common earth, bars are much less necessary than would be supposed. Part of the road between Meriden and Middletown has been recently improved, and on the whole section, which is of natural earth, there is not a bar; and yet you will seldom find a puddle of water in it, or any water running for any great distance upon it.

Mr. SAGE. I wish to inquire what you consider the best form for country roads; I mean, such roads as our people have to use in going ten or fifteen miles from home, through ground that is somewhat stony, and the soil muddy and soft in the spring?

Mr. AUGUR. I should recommend, in the first place, that some means of drainage be adopted. A road is seldom so situated that it cannot be drained. The difficulty with most roads of this kind is, that they are too wet. Then, if the soil is of such a character that it will not make a tolerably hard, compact surface of itself, Telfordize or Macadamize the road with trap-rock, granite or field stone. I meant to have said, that field stones may be used for the bottom of a Telford road; but if you cannot afford trap-rock, field stone or granite put on gravel.

Mr. SAGE. I have thought of a plan to improve a piece of wet, moist road, where it is difficult to trench. Begin at one end and scrape out the dirt for twenty feet, and then lay a bottom of stone, and then put some material on top, as small brush, or anything of that kind, and then take another piece of twenty feet and scrape all the dirt from that which is suitable, on to the first section, and lay the bottom with stone in the same way, and so on through the whole piece. Would not that make a good road?

Mr. AUGUR. The soil of a wet road is very apt to be muck or clay, and neither of these is very suitable material for a road. And as for brush, it may be very good at first, but it will not last. Some people think sod will make a good road, but it soon becomes rotten and tender, and the wheels cut through.

Mr. SAGE. After that is done, would it not be a good plan to put on gravel?

Ar. AUGUR. Yes, sir, I think it would.

Mr. MOORE. The first thing to do in making a road is to get out the water. You may fill in as many stones, and as much dirt as you please, but after all, water will find its way up, by capillary attraction, as they call it. I have seen one instance where the water was got rid of by dig-

ging a hole clear through the hard-pan, down to what geologists call the water-table, and then filling up the hole with loose stones. In some localities that will take away a large amount of water; perhaps take the whole of it away.

Mr. WEST, of Columbia. I believe such places as have been alluded to may be remedied by filling in small stones, so that wheels cannot cut through. I would recommend that the stones be broken with a hammer. I have seen some places, three, four or six rods long, where small stones were filled in, making a bed six, ten or twelve inches deep, and then covered with good earth. In that way a road can be made that will remain for years, with nothing more than ordinary repairs. It is the best way I have been able to find to repair such places.

Mr. SAGE. I refer to roads that have never been cleared from the bottom, where the stones are always working up.

Mr. WEST. Dig out the road, fill in the stones, and cover them up.

Mr. MOORE. The best way is to dig a hole, and let the water go straight down.

Mr. PECK. Do you recommend different widths in the gauge of our vehicles, for the purpose of avoiding ruts?

Mr. AUGUR. I have not thought particularly on that subject, but I should say not. I think some other means should be taken than that. Wherever there are ruts, there is a great deal of strain on the wheels, tracking differently unless the gauge differs very much.

Mr. T. L. HART. How would it do to make the whiffletree longer, so as to get the horse directly in front of the wheel-rut?

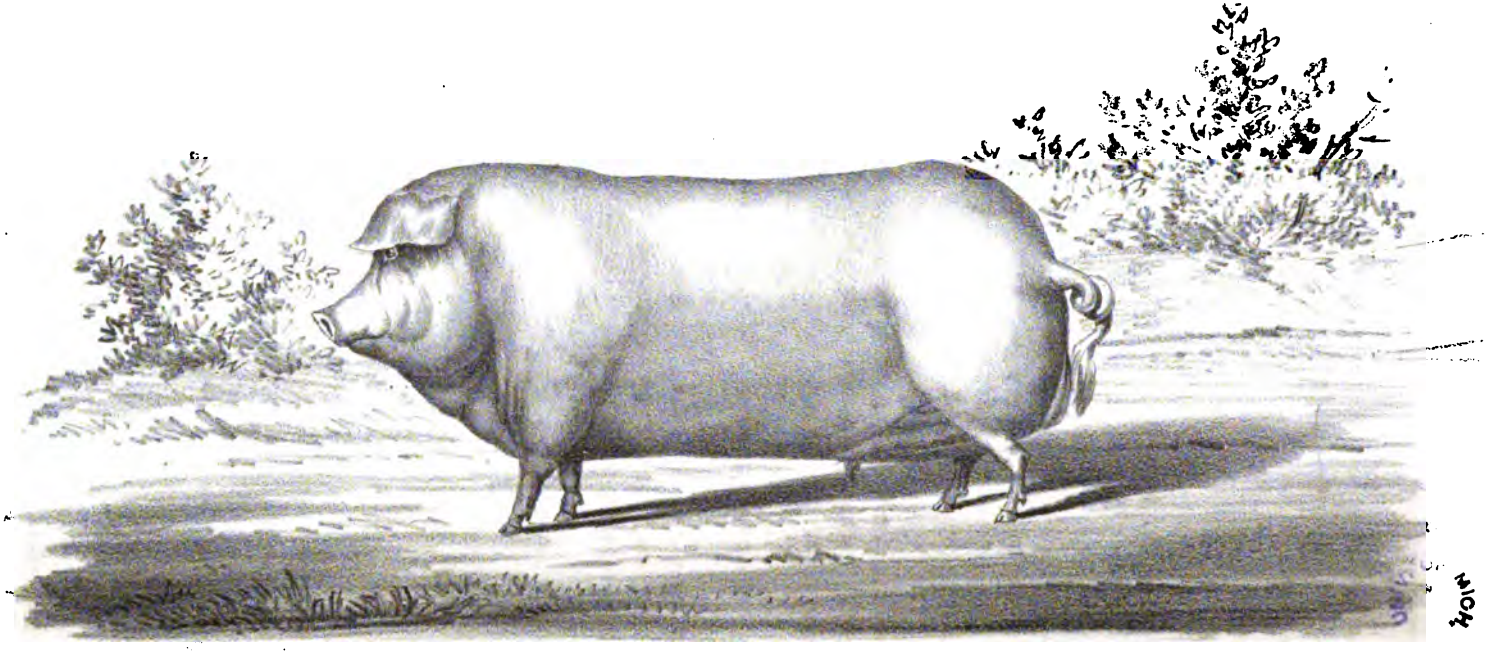
Mr. AUGUR. I do not see that there would be any particular gain in that.

Mr. GOLD. The horse would tread the earth in, and fill up the rut.

Mr. AUGUR. After the ruts are made, the more they are tracked up by the hoofs of horses, the more they are worn by water.

Hon. RICHARD GOODMAN, of Lenox, Mass. I am glad that this discussion has taken place. This is a subject, like a great many others that are announced to come before this meeting, that does not, perhaps, appeal quite so directly to the public mind, or the individual purse, as the questions presented at your former meetings, and therefore I was fearful that not so much interest would be taken in it. But as citizens, interested in the prosperity of the State in which we live, and in that of the whole country, no more important subject could be brought forward for our consideration than this, and it has been as well treated in this lecture as we could expect to have it.

The great difficulty, as it strikes me, in regard to the construction of roads in this country, as in many other things, has been, that we have been trying to make them in a hurry. It is not a thing to be done in a day. It



"AGAMEMNON".

has not been done anywhere else in a day. Men who have been abroad sometimes come home and complain of our roads, after having seen the fine roads in England, and on the continent, forgetting that we, as a nation, are only a hundred years old, and ought not to be compared with a nation a thousand years old. The fact is, that road-making in England is comparatively a new thing. It is not more than two hundred years since they were in just about the same sloughs that we were in a hundred years ago. At that time it was just as difficult to go from Manchester to London as it is now to travel in any part of the west upon the roads. The only way to make the journey was on horseback, or on pack-wagons. You all remember the phrase, "Hobson's choice." It originated in this wise: A man by the name of Hobson, who kept horses for hire, gave every customer the horse that stood nearest the stable door, when he called for one; he could take that horse or none. It is only within the last two hundred years that they have been able to M'Adamize or Telfordize their roads. They have a territory not much larger than one of our States, and they have had population enough to repair their roads, employing children, as they do sometimes, upon them. We have no children to spare for that purpose. We want them at school, or in factories, and will not set them at work on the roads. Our railroads have, in great measure, superseded the necessity for those turnpikes which existed in former times, between the large cities and the capital. But it is important that in country places we should have good roads. They are like the arteries and veins in the human system, through which the blood circulates. The great difficulty is, that they are made for a temporary purpose. Take a road from one country town to another, and the amount annually expended upon it is substantially lost. You will find, in every part of this State, roads which are frequently traveled, which are not a great deal better to-day than they were fifty years ago. The difficulty is, we waste money from year to year, and get no better roads. The suggestion of the lecturer in regard to providing for the permanent improvement of roads, is one we should bear in mind. Take a road between two places, six miles apart. Three or four hundred dollars are spent every year in repairing it. This repair is, of course, under our present system, only a temporary one. We do not put any stone anywhere. We do nothing more than plow up the soil on the side of the road and put it in the centre, which makes the very worst road in the world. It is just as muddy one spring as another. Now the true way is the one suggested by the lecturer—that every year, the towns between which these roads run, should make a permanent improvement, each at its own end. Suppose each town begins at its own end, and M'Adamizes or Telfordizes (whatever system they may adopt) one mile of road. Suppose the towns are ten miles apart, in five years those two towns have made a permanent road,—

assuming that they have drained it, and built it properly,—which, with very slight expense, will last a generation, and perhaps forever. They will have no occasion thereafter to spend four or five hundred dollars a year on that road. An outlay of one hundred dollars a year will keep it in good condition, and make a road over which people can drive, not only in the winter and summer, but in the spring. I do not know how it is with you, the different parts of the country differ in this respect, but I guess the mud is as deep around Hartford and Wethersfield as anywhere. With us, it is almost impossible for people to get through it in spring. And that is the case all over the country. The only way that occurs to me to remedy the difficulty is to carry out the suggestion of the lecturer in reference to the adoption of a system looking to the permanent improvement of the roads.

Another thing. The system of allowing people to work out their taxes on the road, is probably the worst we ever had. We abolished it in Massachusetts, luckily, in 1871, so that there is now no working out of taxes on the road in that State, but there is a money tax. Commissioners are appointed who have charge of the roads, and as only one goes out every year, there is always one kept in who knows something about it. But that system is not perfect. The system in vogue in England is a great deal better than that. There the parishes make the roads; they are liable for all accidents; they elect a surveyor, and that surveyor is obliged to perform his duty; he is answerable to the highest authority of the kingdom. We shall have to adopt a similar system in this country, before we shall have perfect roads. The Legislature will have to perfect a system of road-making, and appoint commissioners to superintend the work done by the surveyors elected or appointed, in the various counties. When we get that system fairly established, we shall begin to have good roads.

I understand that there is a worse system here than that of working out the taxes, that is, of letting the roads out for three or five years to the lowest bidder. All experience is against any system like that. In the time of Louis XIV, in France, there was established what was called the Corvee system, which was exactly like our old system, in which men who did not understand the business worked the roads. When Turgot, his great Minister, came in, he investigated that subject, and found that the expense of working the roads was three times as much as where it was done by raising a money tax and employing competent men to perform the work. Therefore I say we shall never get good roads until we adopt the system of raising the money for the work by taxation and putting in competent men to see that the work is well and thoroughly done. When we arrive at that, when we have a State Superintendent, and have some authority to compel the towns to make permanent and good roads every

year, as suggested here, instead of temporary and bad roads, we shall probably have good turnpikes, and not until then.

Mr. AVERY, of Groton. There is one great obstacle to carrying out the ideas which have been presented here by Mr. Augur in his address. In the town where I am acquainted, the practical difficulty has been the expense involved. All would like good roads, but the trouble is they cost too much. Now, here is an idea in that connection which seems to me to be of importance. People are continually changing their locations, of course. No one is so fixed in his position but what he may change it. There are always strangers coming into our towns. There was a question came up in the Legislature of 1865, and the fact was ascertained, that in some of the shore towns, particularly between New Haven and New York, more taxes were paid by those who had come into those localities than by the original inhabitants. In New London, Groton, Stonington, and all those shore towns, a large amount of the taxes is paid by those who have come in from other places. Now, one of the first questions, when a stranger comes into town is, "How are your roads? Are they pretty good, or are they almost impassible?" It seems to me that that is a consideration which ought to have weight with our tax-payers. A man says, "I would like a good road but I am not willing to pay for it." But suppose by making a good road, some wealthy man is induced to come into the town, he may get, not seven per cent. only for his money, but fifteen or twenty per cent. A road was contemplated from the village of Mystic, down to Niantic, where there were a few houses, occupied by some smackmen, carrying on their business, and the town of Groton was so unwise as to fight it, at an expense of some four thousand dollars, and it cost $1,500 to build the road. There were only some six or eight houses down there at that time, and now there is more than a million dollars of taxable property there, two churches, and a flourishing village, which has grown up out of that enterprise. We had the same experience on the other side of the town, we had to fight there four years to get a road, and we had a taxable property of over $100,000 at the time. Still the town fought us four years. It cost somewhere between three and four thousand dollars to build the road there, and it cost ten thousand dollars to fight it. The fight was more expensive than the road.

The first thing for any locality is to get good roads, I do not care if it is a farming locality, for the first question a man asks, if he is going to buy a farm, is, "what are the roads in that town?" We started an enterprise around the Pequot, below New London, some years ago, and the city of New London voted eight thousand dollars to put a nice street through, and do it right up, so that there should not be any trouble about it in the future. It is the nicest place to trot a horse there is anywhere, for about

three miles. They expended eight thousand dollars, and put the road through to the Pequot House. That was the first house built—there was not much property there then—and they carried this road down to that house. The result has been, as I am informed by one of the most intelligent men in New London, that there is probably more than two millions of taxable property in the immediate vicinity of the Pequot House, and last winter there were some ten or twelve cottages, costing four or five thousand dollars apiece, built immediately in the vicinity of that house.

Now, gentlemen, the fact is this, although it may cost you something to get good roads, it is one of the best investments you can make, and any man who is going to a locality, whether as a gentleman of leisure or as a man of business, whether he wants to buy a farm to improve, or to sell for building lots, one of the first things he will ask will be, "have you got good roads?" There is no question about it at all in my mind.

Mr. P. M. AUGUR. As a single illustration of the advantage of making these permanent improvements, I want to mention a case. Between my house and the city of Middletown, during the past year, there has been an improvement made of this character. There were two streams, crossed by two bridges, about ten rods apart. Between those two bridges was a depression of from four to six feet, which of course had to be descended by any team going either way. That road has probably been traveled from 150 to 200 years. This year a true grade has been made between those two places, and the question is not whether that improvement is equal to the interest of the money, but whether that improvement is not equal to the whole cost, in a single year? I believe it is. I believe it can be proved that it is. I know that it is. And when we reckon the amount of travel, which is very great over that road, it will easily be seen that that amount will be saved for all future time; consequently, the advantage is very great. I believe that in every town in the State there are instances where an outlay of perhaps two or three hundred dollars would effect an improvement which would be so marked that it would lead to other improvements in the same direction, by which we should be vastly benefited.

Mr. GOLD. I think this is a pretty good place to talk over the subject of roads. I remember coming over here, some twenty-five years ago, and going from Winsted to Winchester, and I used to be familiar with the up-and-down road and heavy grades between this place and that village on the hills. By a wise system of grading, similar to that which Mr. Augur described, it is now a very fine and easy drive, and I understand that the road from here to Colebrook has been improved in the same manner. Those steep hills have been graded down or avoided. The people residing here have within their personal knowledge good examples of just what we are trying to enforce upon the people of the State. I do not know any better

example than what you have done right here in the neighborhood of this borough.

Mr. SEDGWICK. Probably one of the causes of the decrease in the population of our hill towns is to be found in the fact that they have such poor roads. The way the roads have been worked, under the contract system, and by taxes being worked out upon them, it has been impossible for a farmer to live in one of the hill towns and travel with any comfort over the roads to and from market. I am so situated that I am six miles from any centre. I have to travel six miles in each direction to strike a railroad. It is a very important thing for me to have good roads, and not only that, but I am willing to pay for them, if I can have them. But I cannot have them, for two reasons that have just been stated. One is, the contract system, by which my neighbors in town can take contracts on the roads, and are determined to make money out of the town, and therefore will not lay out a dollar more than their contract calls for; and the other is, the system whereby we are working out our taxes on the roads, and when we are engaged in that work, we are apt to lean on our hoes pretty heavily. Mr. Avery has struck the key-note about our building roads. You are probably cognizant of the fact, that all along our Housatonic valley, we are trying to attract people to locate with us, and build summer residences; and as he says, the first question they ask is, "Have you good roads?" Now, in Stockbridge, Mass., they have probably as good roads as anywhere, and they have attracted as good a class of residents as is to be found in any town in the State. There is a gentleman in my vicinity who will be obliged to leave the place because he cannot have roads, good enough for him to drive on. Why can we not have good roads? In the town of Cornwall, we have 100 miles of road, and we have a tax of ten mills largely expended on roads and bridges. Every year this work has to be done over. We have, I am happy to say, undertaken some jobs which have been done in a permanent manner. If we could repair all our roads in that way, how many thousand dollars it would add to our taxable property! Every summer we have some three hundred people who come from abroad to board with us, and if we can make the town attractive to this class of people it is money in our pockets. I, for one, do not begrudge a dollar paid out for good roads.

Mr. PERKINS, of Winsted. The great difficulty is that the expense of repairing roads and bridges is often as great in towns of low valuation, where the total grand list is from $400,000 to $800,000, as it is in towns where the valuation is from one to three millions. In these poor towns, if you allow them twenty dollars per mile annually for ordinary repairs of road, and ten dollars for repairs of bridges, you will find that you have a tax of from 4 or 5 mills to a cent on a dollar merely for those repairs. That

is, the tax payers must pay one dollar on the hundred in taxes to produce that little pittance of thirty dollars per mile, for ordinary repairs on the roads and bridges. Winchester has a valuation six times as large as Colebrook, where the roads cost just about as much as in Winchester. There is where the hardship comes in, and if you put these road taxes too high, you will drive every land-holder out of the town, and certainly one-half of the land-holders are ready enough to leave now, and the other half are anxious to follow the first. Some way must be contrived to have roads, and yet keep taxation within reasonable bounds. But to M'Adamize twenty or thirty miles of road is entirely out of the question. It would take the last dollar in a good many towns to pay the tax-collector, and I do not know who would be left to bid off the property. Therefore I should say, in brief, that it is very unfortunate to be extremely poor and yet have expensive roads and bridges to maintain. I am speaking on this subject from actual observation, having had a great deal to do with roads for some thirty-five years. A poverty town, and poor roads in that town, must, to some extent, accompany each other, until they stop the use of roads, and that time is not likely to come as long as these poor towns are inhabited.

Mr. Avery. I would make one suggestion in reply to the gentleman, and that is this: I have had some experience in making roads. I had a contract in our town for three years, and have acted as surveyor in the repairs of roads considerably, and I am fully impressed with this idea, that country roads generally are made too narrow, and it costs more to keep them in repair for that reason. In my town, certainly, and it may be so in the town where the last speaker resides, the roads have sometimes been repaired by plowing up the sides and throwing the earth on to the middle, instead of widening the road. The wider a road is the less the surface is gullied up. Now, if you can have your road wide enough, so that when a loaded team passes over it, it will not press out the edges of the road, there is a permanent improvement; but simply to plow up the edge of the road and round the middle does very little good. A few months' travel will wear deep ruts, and your road will be just as bad as it was before. That is the result of my observation and experience. My special aim, when I had charge of the repair of roads, was to widen them, so that there would be edge enough to hold the rut, and prevent the side of the road from being crowded out by the passage of heavy teams. Use your money in widening your road instead of rounding it up very narrow, and in that way the same amount of money will go a great deal further.

Mr. ———. If you owned a five thousand dollar farm in the town of Voluntown or Sterling, would you vote in town meeting to widen the roads?

Mr. AVERY. I have previously answered that question, but I will answer it again. I would lay out $500, $1,000, $2,500, or whatever it cost, to repair the roads in town, and unless there were ledges, or something of that kind in the way, my first object would be to widen those roads; plow the edge, and turn enough back to widen the road, and give more space for the travel. When your roads are repaired in that way they will stand. I do not wish to boast—I have nothing to boast of—but I had a contract for some four miles of road for three years, and when I left that road, there was not one of those "thankeemarms" on it, there was not a place where the edge had been broken away, because I had widened it enough so that the edges would hold. I would widen a road the first thing I did, whether I had much money or little.

QUESTION. I would like to know what the standard width of a road should be?

Mr. AVERY. Well, I would certainly have a road not less than twenty feet wide.

QUESTION. You mean from outside ditch to outside?

Mr. AVERY. Well, if I was going to take a road to keep in repair for ten years, I would, unless it would cost a great deal for blasting ledges, or something of that kind, make the surface of that road twenty feet wide, at least; it would cost me less to keep it in repair during the ten years than if I narrowed it down to fifteen feet. I recollect meeting a man with a loaded team on a road at one time. The road was not as wide as it ought to have been. He was very accommodating in the matter and turned out, and the consequence was he came very near getting his team set. His wheel, as he turned towards the side of the road, came very near going over the edge. Here is a practical result of narrow roads; in the spring your wheels will go half way to the hub, and perhaps if it holds soft they will go to the hub; whereas, if the road were wide enough, the edge would not be pressing out or the rut pressing down.

Mr. WADHAMS, of Goshen. I am in sympathy with all the gentlemen who have spoken, and peculiarly so with the gentlemen who spoke before the last. I happen to be located in one of those hill towns, poor towns, with a hundred miles of road, and we have to lay out something like twenty dollars a mile annually upon our roads. We would like such roads as the gentleman who has given us the address this afternoon talks of, but can we make them? I suppose that if to-day our hundred miles of road had been so improved, the town would not be able to pay the expense of the roads; our whole property would not be sufficient to do it; and therefore we have to take the usual course, and get along more cheaply.

The gentleman has spoken of the the contract system. In the region where I live, we have let the roads to the lowest bidder for periods of five

years. We have been practicing that system for the last forty-five years, and we are now about letting them for another five years, making half a century. It has been said here that the roads, under that system, would get so they would be impassable, that they would be narrowed up, and all that; but we have managed to live on them and ride over them. They are not as good as we desire perhaps, but as good as we can afford. The vote of the town is, that our roads shall be let by a committee of three, appointed for the purpose, to the lowest bidder, with discretionary power on the part of the committee to reject bids, so that they are not compelled to let every piece at public sale. The roads are to be repaired to the acceptance of a disinterested commission appointed by the selectmen men of the town, inspected in June and November, and if accepted by that commission, the contractor is to have two-thirds of his money in the spring, and the other third in the fall. Some of our roads cost five dollars per mile annual repairs; some fifty dollars. We have no manufactures; we have no wealth; we are farmers. We have had to learn to make roads ourselves, and travel on them. We have a grand list of eight or nine hundred thousand dollars. We have got along under this plan, and believe it as good a one as we can adopt, with our means. The roads are repaired by hauling the surface dirt on without any filling. As I say, we would like better roads, but I do not see how under heaven we are going to get them. I came here hoping that some plan would be suggested by which we could get them cheaply. One gentleman has said that when people come into town, the first inquiry is, "are your roads good?" Our experience up in the hills is a little different. Oftener they inquire, "what are your taxes?"

Mr. N. HART, of W. Cornwall. That is the question I was just going to ask you: How many mills on the dollar is the tax in your town?

Mr. WADHAMS. Six mills. How many mills in your town?

Mr. HART. Eleven.

Mr. WADHAMS. Are your roads any better than ours?

Mr. HART. Not so good.

Mr. SEDGWICK. The roads in Goshen can be kept in repair cheaper than in any other town in Litchfield county. The principal roads are mainly level, and they have very few ledges, or anything of that kind, to go through.

In connection with this road business, I may state that I think a good many towns are working too many miles of road; they are working more roads than are necessary for the good of the town. By that I mean that in every town there are a few main roads, which ought to be kept in first-rate condition, and there are side roads which do not need a large amount laid out on them to make them passable. But if a man is a little one-side, as I am, he wants as good a road as his neighbors, who live on the main road, and he directs his efforts to that end. But I am satisfied in my own

mind that that is not the thing. We want the principal part of the money raised for roads spent on those that are traveled the most, and then we shall have better roads.

Mr. WADHAMS. That is the plan adopted by the town of Goshen. The contractor makes up his mind what is required on a road, and makes his bid in accordance with it. As I said, we have some roads on which we lay out fifty dollars a mile, and some on which we lay out less than five. Mr. Sedgwick says, and I agree with him, that the important roads should be worked up to a point that other roads do not need; but when he says he thinks we have too many roads, I don't know about that. I think our town is discontinuing roads, is it not, to your knowledge?

Mr. SEDGWICK. Much to our sorrow.

Mr. WADHAMS. Well, I think they treat you meanly. The past year, our town, very unwisely, very unjustly, has discontinued roads that are not thoroughfares, but roads to farms, and appendages to farms, which have been bought with reference to the facility of getting to them by these public highways. Our town has, in three or four instances, thrown them out. I do not believe in it; I believe it is bad policy for the town; but still, these roads ought not to have the same amount expended on them which the main roads should have. But we believe our system is the correct one. We believe that if a man takes a piece of road under contract, it is for his individual interest to work that road economically. A man with a pair of oxen and a boy to drive, with a plow and scraper, will do as much according to my experience, under the contract system, upon any piece of road, as four men will do in a day, upon an average, working by the day. It is his individual business. He is to accomplish a certain amount of work, and he does not want to spend a dollar beyond what is necessary. It is for his interest to work personally and honestly to get his work accepted. I would not ask him to do more than his contract calls for. If he can make money on it, very well. If he gets twenty-five dollars for a piece of road in my neighborhood that I can repair for twelve, all right. The next time I will bid on the road. I like the contract system. As I have said, we have followed it for forty-five years. Mr. Hart intimates that our roads are as good as those in his town, and the taxes are not very high. We should like better roads, but we do not know how to build them and pay for them.

Mr. CLARK. The question of the construction of our public highways is one of great importance, and should be thoroughly considered. It is claimed, and I suppose rightly, that half the towns in this State are not able to adopt a better system of road-making; that they are too poor. And what is to be done? It seems to me that the proper thing to be done is for those towns to adopt a correct system, and carry it out as fast as they are

able; not diffuse their tax over the whole roadway of the town, but concentrate it, and make one piece of road a model piece, such as will commend itself to the traveling public. If these poor towns cannot do much at first, they can do a few yards in one year; pass a vote to the effect that so much shall be done according to modern ideas on the subject of road-making. Let the experiment be tried, and continue it from year to year, until it shall commend itself to the public, and be thoroughly incorporated into the policy of the town. That is my idea. In the city of Hartford we are greatly in debt, like all other cities—four or five millions. It was proposed in town meeting, as we could not, of course, pay off this immense debt at once, that we should lay a tax of half a cent on a dollar, to form a sinking fund, which would gradually pay off that debt. This would be the same principle. Let the towns each take a piece of road and make it such as it should be, and go on with their old system elsewhere. I think much can be accomplished in this way. At all events, I throw out that suggestion for the consideration of gentlemen who may be interested in this subject.

Mr. HUBBARD, of Middletown. The case of a small and poor town, with a large amount of roadway, requiring a heavy expenditure, is worthy of sympathy. The case of poverty anywhere is worthy of sympathy, and of every aid that anybody can suggest. It is embarrassing for a town to be poor, as it is for an individual; but I do not know that the principles of management are any different in the case of a town from what they would be in the case of an individual. Suppose a man owns a poor farm; he may own nothing else; he may be in debt for part of that; his farm needs improvement. What is he to do? Is he to sit down and say—"It is about all I can do to get a living off this farm, and as for improvement, it is no use; I will simply work along and get a living, and let it go just as it is." Is that the spirit in which any man must take hold of a work like that? Is that the spirit in which we must face any such difficulty as that? I think not. I think we should attempt improvements. Some towns, of course, must begin in a very small way; but this fact must be considered, that any farm that needs improvement, or any road that needs improvement, as long as the improvement is not made, much of the labor expended on the farm or the road is expended to poor advantage. Much of the labor that is spent in hauling loads over the roads in Goshen is wasted; and so it is in every town in the State. So on the farm, much of the labor that is expended in raising crops is wasted, because the necessary improvements are not made. I do not like to see the spirit that prompts a man to sit down before a difficulty with folded hands, and say, "I can do no better than before; I can make no improvement. I must float with my head just out of water, and not attempt to get out on the solid land. I think the town of Goshen had

better lay a tax of ten mills, as they do in Cornwall, and begin judiciously on a system which will ensure good results in the future. Let them begin and put one piece of road in good condition; that will release them from the annual expense of keeping that piece of road in repair. It is a sinking fund, as the gentleman from Hartford has so pertinently said. Then they can go on and make an annual expenditure upon different pieces of road, and finally they will get all their roads in good condition.

Mr. WADHAMS. The intimation is that our roads are so miserable as to be impassable. We have the testimony of the gentleman from Cornwall that our roads are four times as good as theirs. I don't want the impression to go out that our roads are worse than others. I believe them to be better.

Mr. HUBBARD. I did not mean to convey the impression that the roads in Goshen were impassable or specially bad, but that all our roads were bad, especially where they have gone on, as I understand the gentleman to say has been the practice in his town, simply keeping the roads up. He gave me the impression, perhaps it is an erroneous one, that they did not attempt to make any improvement, but simply to keep the roads in passable repair.

Mr. WADHAMS. As a general thing we have occasionally expended a few hundred dollars for the purpose of grading. But, as I said, we calculate that from a little money, judiciously expended, we have got more worth than we should from a larger amount expended in some other way, because we have made it for the interest of the contractor to do his work well, in order to get the roads accepted.*

Mr. HUBBARD. In regard to that contract system, I think the town of Goshen has been extremely fortunate in its contractors. We have tried that system in Middletown, and somehow or other we fell into the hands of a very different class of people. It was not for their individual interest to put the roads in good condition, but to get their money and do just as little work as they possibly could.

Mr. WADHAMS. That is generally the case with us. Not always, but generally the case.

Mr. HUBBARD. That being the case, there is this other point to be considered. Any specification of a contract for the repair of a road, six, eight, or ten miles in length, for five years, must of necessity be vague. In our case, it is simply that the roads are to be kept in good order and repair, to the acceptance of a disinterested inspector. Well, that disinterested in-

* Mr. Hubbard is not acquainted with Goshen. One of the richest agricultural towns in the State, all public and private obligations are met with promptness. The farmers of Goshen never shrink from any duty. The roads are as good as they can well be made of the material used, (common earth,) and are not surpassed by those of any other town in the county. Many of the roads are level, and would be benefited by a better drainage and coating of gravel. Adjoining towns look to Goshen to set an example in this direction. T. S. G.

spector was selected from another town, and the contractor took him over the road when there had not been any rain for some time, and asked him "if it was a reasonable road," and he said "it was a good road." I have known a road, for the repair of which the contractor received $130 a mile, where I honestly believe the amount expended did not equal $30. A hundred dollars a mile went into the pocket of the contractor, for which he gave no equivalent whatever.

Mr. WADHAMS. Were your roads let out at public sale?

Mr. HUBBARD. I think not. I do not know whether they were or not.

Mr. WADHAMS. If they were it was right that he should make all the money he could.

Mr. HUBBARD. It may be all right that he should make all the money he could, but I do not want to pay taxes in that way. When I pay for working a road, I want the money expended on the road, and in that case it was not; it went into the contractor's pocket, and nothing was done on the road. That has been the way the contract system has worked. I think it is about the meanest way to work our roads that was ever invented. It is a system for getting the town's money into the pockets of the contractor, he rendering no equivalent therefor.

Mr. N. HART. They have no "rings" in Goshen.

Mr. HUBBARD. Then they are very fortunate indeed. I want simply to say, that where a town is poor, the same principles must apply as where an individual is poor. Where expenses are large, and income is small, the income must be spent with far more wisdom and economy than where it is ample. Certainly if there is any system by which our roads can be permanently improved, and this constantly recurring annual expense reduced, those towns which are poor, and have large burdens in the way of road repairs, are the very places where the new system should be put in operation. But I protest against sitting down before a difficulty, and giving up any thoughts of improvement. We want better roads, not only in the small towns, but in the large ones, and we want to face the difficulties of the question fairly and squarely, with a determination to overcome them, whether our means be large or small.

Mr. ROCKWELL, of Winsted. A great deal of trouble and expense is often occasioned from the lack of a little money expended judiciously in turning water from our highways, both natural streams and surface water. I have no doubt that many gentlemen present, very likely all, have in their minds, places where, during the time of freshets, the water over-flows from the hill sides and washes away quite a length of road, causing considerable expense in repairing the damage. There are places that are almost as regularly washed as we have a freshet. I know such places, where a little money expended in enlarging sluices and bridges, in making break-waters,

and in turning the water from the road, and passing it under and by, would save an annual expense of a considerable amount.

Another serious objection to the way of working our roads is the fact, that water is allowed to fill the ditches for long distances, and to accumulate in such a large volume that it washes away the shoulders of the road, causing considerable expense for repairing them again. My theory is, that the water should be turned from the road frequently, so as not to allow a volume to accumulate; and those places where the water comes from the hill side, in the time of great rains, should be protected by large bridges and sluices, or break-waters. These are of the nature of permanent improvements, What I have said in regard to this want applies to all kinds of road, in our large, rich towns, as well as in our small and poor ones. It makes no difference whether a town is poor or rich as to the character of the repairs of roads; when once made, it should be permanent; and then we should have some degree of progress. It need not necessarily be costly.

Mr. WADHAMS. The difficulty the gentlemen speaks of is guarded against by the contract system. I have a mile of road under contract, half a mile each side my house, and I take a little pride in keeping it passable. I want to do it as cheaply as possible, because I get but twenty dollars a mile. Proceeding in the fall to guard the road, I patch up the "Indian graves" a little, and after the turf gets rotted, I take out my hoe and turn off the water. An hour's work with a hoe will sometimes save a day's work of a man with a scraper. The contract system makes a man interested to guard the road as he would any other property.

Mr. GOLD. A question has been handed me that comes in well in connection with this subject: "Will the planting of trees by the highway pay the expense of planting, and of sufficient care to ensure their growth?" It is my opinion that it will, and I show my faith by my works, having planted the sides of most of my highways with trees.

Mr. STEWART. Fruit trees or shade trees?

Mr. GOLD. I have planted mostly with shade trees. I have in my mind a case where fruit trees have been planted very successfully; but more particularly I have in mind a road planted some fifty years ago, with shade trees. A gentlemen who bought a farm in this county some fifty years ago, told me that the first day's work that he did on his farm, with his hired man, in the spring, was to plant maples in the street in front of his land. He sold that farm a few years ago to a man who had no particular eye for the beautiful, but the tree-planter told me that nothwithstanding that, he believed he got five hundred dollars more for his farm because those trees stood there in the highway, than he would if they had not been there. So that he got rich returns for the day that he spent in planting those trees. The farm to which I refer is well known to many of you. It is in the edge

New Hartford, between there and Torringford. Deacon Watson was the gentleman who planted those trees, and I mention his name with honor, as having in those early days set us an example which we would do well to follow. The farm is known to every traveler through that part of the State for the beauty of the avenue, lined with the maples.

Mr. HOYT. Our people have come to the conclusion that it is absolutely necessary to make permanent improvements on our roads every year. From our nearness to and ease of access from New York, we have a great many people residing with us in the summer. We have a great many high hills. We have already graded down one hill this season, and we have another one under contract. Our deepest fill is eight feet. We have cut five feet off of the top. It was formerly hard work for a team to draw 1,500 pounds up that hill. The same team could probably now take a load of from a ton and a half to two tons up the hill easier than it could take 1,500 pounds before. Our people calculate to do some such job every year.

Mr. T. L. HART. I agree with the gentleman last up, and I believe one way to improve our roads, is by setting out trees, as Mr. Gold has mentioned, and we can improve them in that way at less expense than in any other. It costs but very little to take up a few trees every spring, five, ten or fifteen, and set them out by the wayside; it costs but very little to take care of them from year to year, and the growth will be sufficient in a very few years to pay the whole expense of improving the road and the cost of the transplanting in addition. Some few years ago our farmer's club in Cornwall passed a vote recommending or advising each member to set out at least five trees each year on the highway. Some of them did it, and the consequence is, we have now a large number of trees, some of which are eight, ten and twelve inches through, and serve greatly to beautify the road. In one case, about one hundred cherry trees were set out, and last summer I have no doubt that there were at least a hundred bushels of cherries growing on the highway. Certainly, I went upon two of the trees and picked a bushel off of each, and they were nothing like gone then. At the price which such fruit brings in the market, which is about a York shilling a quart, the last crop would have paid the whole expense of setting out those trees. To say nothing of beautifying the highway, to say nothing of the pleasure of riding beneath their shade, when the sun is hot on a summer day, the crop itself would certainly have paid vastly more than the whole expense of setting out and taking care of those trees. And then again, the amount of wood that would grow in twenty or twenty-five years would pay the expense twice over, I might say ten times over, of setting out the trees.

One word in reference to how they should be set out. I noticed that considerable has been done in this direction in Litchfield county. Some have set

their trees next to the line of the fence, whereas, if they had set them as near the road as they could be without interfering with travel and repairs, they would have furnished a shade which would have been valuable to the traveling community, and the owner's lot would not have been shaded and injured as it has been by setting them out so near.

How should they be set out? I would recommend that a deep, broad hole be dug, sufficient to take in all the roots without bending them. The maple may be very easily taken up; the roots run on the surface, most of them. Then cut off all the top, six or eight feet, may be, and set them out, throwing in a pail of water, and thowing on the dirt. Then, with a little care in August, if there comes a dry time, they will get a foothold, so that they will need but little care to make them grow. The great difficulty arises from leaving on the whole top. A farmer who sets out trees wants to have them grow at once, so he leaves the tops on. He does not seem to understand that if he cuts off the entire top, the tree will be a great deal more likely to live, and in five years will have more top than if he left it all on. Besides, if the top is left on, before the roots get hold, the tree will be swayed by the wind, and perhaps turned over; whereas, if the top is removed, there will be nothing for the wind to lay hold of, and the tree will be more sure to stand well and get a fair growth.

I think there is nothing to which farmers can turn their attention with greater profit than the setting of trees by the wayside. I would recommend the maple and elm, although it is a great deal of trouble to take up an elm, because the roots go right down into the ground, unless it is in a swamp. A maple can be taken up with a crowbar, shovel and hoe, and it will cost but very little to remove it. The farm to which I have referred, would sell for two or three thousand dollars more from the fact that the highway is shaded by trees. It is a luxury to go through that grove on a warm day.

Mr. PERKINS. Ten years ago last spring, I moved from Massachusetts to this State. The last of October, 1865, I set out twenty or twenty two maple trees, a mile from the village where I now stand. I did not cut off the top of any one of them, and every one of them lived. I should not want any one to cut off the top of a maple, or any forest tree that I wanted to set in front of my house, if I wanted to see a stately tree. If you want a low, bushy tree, of course you would cut off the top.

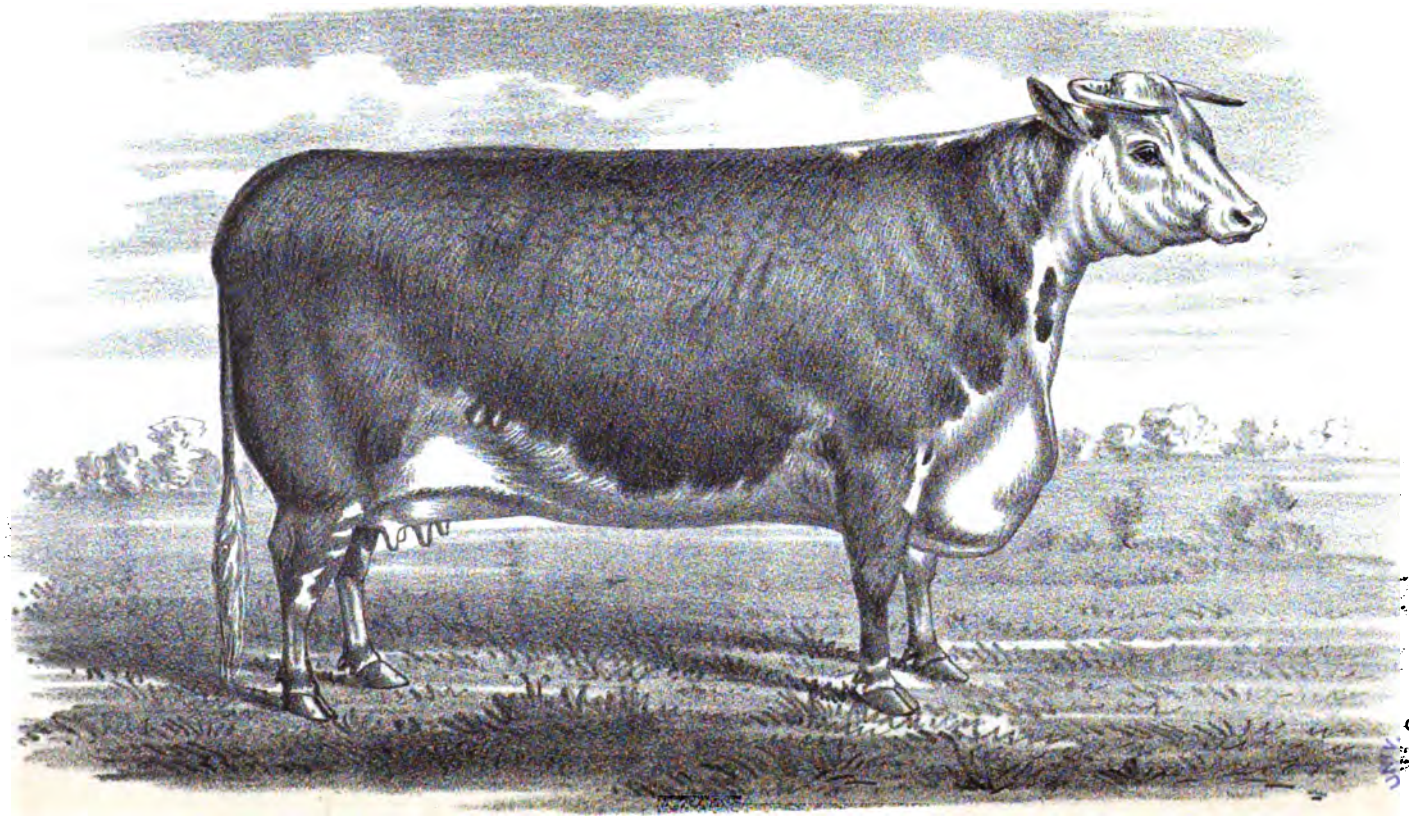
Mr. T. L. HART. The experience of the last speaker does not correspond with mine. I have scarcely lost a tree when the head was cut off. A tree will throw out three times as many thrifty shoots when headed in, as it will if the top is allowed to remain.

INSECTS NEVER GROW.

BY S. S. RATHVON.

Many fancy that a little fly is only little because it is young, and that it will grow up in process of time to be as big as a blue-bottle. Now this is entirely wrong, for when an insect has once attained to its winged state it grows no more. All the growing, and most part of the eating, is done in its previous state of life, and indeed there are many insects, such as the silk worm moth, which do not eat at all from the time that they assume the chrysalis state to the time they die.—*Church Union.*

"That's so"—and yet it is only so in a qualified sense, for there are some insects that never attain to a winged state; that is, they are either totally wingless, or are so seldom seen in that state that most persons never know otherwise than that they are wingless always. Especially is this the case with ants, fleas, spring-tails, and the females of some bugs, grasshoppers, crickets, beetles, moths, flies, and all lice, as well as many others. Although it is not strictly true that "insects never grow," yet it is true that they never grow after that stage of development when the large body of the insect world attained to a winged state; but there are some *orders* of insects to which the rule may be applied almost universally. There is nothing that is more likely to leave a false impression upon the minds of the superficial on this subject than the *appearance* that insects do grow without any qualification whatever. Indeed we often meet persons thoroughly informed on many other subjects, who suppose that the different sizes in insects, of apparently the same kinds, are indications of different ages. Practically there are four more or less directly marked periods in the life of insects, and are the *ova*, or egg state; the *larva*, or worm state; the *pupa*, or intermediate state, and *imago*, or adult state; and in one or the other of these states the species are perpetuated, or carried over from one season to another. In beetles, butterflies, moths, bees, wasps, hornets, flies, dragon-flies, and some, these states, as a general rule, are very distinctly marked; but they are not so in bugs, cockroaches, locusts, earwings, grasshoppers, treehoppers, crickets, and a number of others. In this latitude, perhaps, the one particular species, (except the common house-fly,) which impresses itself earliest and the most indelibly upon the minds of youth or adult age, is the common "tumble-bug" or "tumble-dung," from its habits of forming a ball out of animal excretions, and rolling it for some distance before burying it in the earth. This is the *Canthon lævis* of entomologists, although there are various species of them.



Hereford Cow **DOLLY VARDEN**

UNIV. OF MICH.

Now from more than fifty years ago, when we made the first observation, down to five and thirty years ago, we were under the impression that the various sizes of these insects, found in the droppings of cattle, were the young and the old of the same species. For had we not over and over again deprived the industrious and persevering owners of these balls, opened them, and found therein a small black beetle, approximating in form to the former possessors of the ball, and what else, we thought, could they possibly be if they were not their legitimate offspring? These little black beetles, we subsequently learned, were not only different species, but belonged to different genera, *Aphodius*, *Onthophagus* and others. Nor did the fact that we sometimes found within these balls little beetles that were not entirely black—the hinder half of the body being mottled with clay yellow—astonish us any more than that we should occasionally see a robin, a catbird, or a mouse, that was altogether or nearly white.

But since then it has been demonstrated to us a thousand times, clear as the light of the living day, that these beetles do not grow or acquire any new beauty after they have assumed the beetle form—nor any other species belonging to the same order—and that all the different sizes indicate different species, or varieties of the same species. The eggs, however, of some insects do very perceptibly increase in size, and the *larva* or grub grows, and sometimes grows very rapidly, in all of them. But there is as much difference in the size of the *larva* as there is in the size of the beetles into which they are subsequently transformed. As a general thing the mature beetles, if they feed on anything at all, it is on a different substance from which the larva fed upon. We may except the carniverous species, and some of the CHRYSOMELANS—the "Colorado potato beetles," the "Tortoise beetles," &c., &c., for instance; under any circumstances, however, it is while they are in the larva state that they increase in size, or grow, and it is during that state that the destructive kinds are the most destructive. Like active and hungry boys, they are always hungry and can always eat. Indeed, childhood and youth may be appropriately regarded as the larval period of manhood, and the future perfection of the insect depends as much upon a plentiful supply of healthy food as the physical perfection of manhood depends upon proper food and physical training whilst in the boy state. During the *pupa* or intermediate state, beetles eat nothing. Some eat nothing, or next to nothing, in the *imago* state; but others eat fruit, foliage, pollen, flowers, and the predaceous kinds feed on carrion or other small insects, grubs, water animals, or fishes, &c., &c.

The *larva* of butterflies and moths, which are known under the names of caterpillars, cut-worms, sphinxes, or simply worms, all grow; and in many instances grow very rapidly; and during that period feed very ravenously, eating their own bulk and weight in a single day; but after they have

assumed the butterfly and moth forms they never grow any. They not only do not grow, but they acquire no new beauties, but rather lose their original beauty the older they get, and we often see them awkwardly flitting about in faded and tattered garments, dilapidated caricatures of their former selves. The best specimens obtained by entomologists, are those which are bred under their own personal supervision. Therefore, all the different sizes of these insects we see, are indications of different species, except, as before stated, the different varieties or sizes in the same species, which may have been caused by contingencies beyond the control of the insects, such as stinted food, inferior quality of the food, or unfriendly weather and surroundings. In no other *order* of insects, universally considered, is there a more marked distinction in form and habits—between the *larva*, the *pupa*, and the *imago*—than there is in that which includes the butterflies and moths. The *larvæ* are masticating animals, the *pupæ* are quiescent and fixed, and the *imagœ* are suctorial in their feeding habits.

In the order *Diptera*, or two-winged flies, the case is the same, that is, they do not grow after they have assumed the form of a fly, notwithstanding the great variety in the sizes of the masses that are sometimes found congregated together, may appear as if they were young and old, but it is only an *appearance*, for, in reality, the smallest fly may happen to be the oldest, and *vice versa*. It is the same in others mentioned and unmentioned, after they have acquired wings, namely, they *do not grow*. It will be remembered that in the foregoing the larvæ are excluded from the eggs in the form of grubs, worms, caterpillars, maggots, &c., some entirely footless, and others having from six to twenty-two feet; but in those which follow, the *larva* come from the eggs in form of the mature insects—or nearly so—lacking only the wings; having the usual six feet, the mandibulated or suctorial mouths the same, in all their states of transition, and feed throughout the entire periods of their lives; and consequently have no quiescent period, but are as active and destructive in one state as they are in the other. In these it may appear to the novice that insects *do grow*, from the fact that he may not be able to distinguish between larva, pupa and imago, but even in these they do not grow after they get wings, although some of them never attain those appendages, whether they are males or females, or whether they are old or young.

Grasshoppers *(true,)* locusts and crickets, for instance, have the same number and the same formed limbs when young they ever have, and can hop from the moment they leave the eggs. This is the same in regard to the true bugs, the tree-hoppers, the false locusts, and approximately many others that do not hop. Therefore, to say that "insects do not grow," without any qualification whatever, would not be credited by those who may have the demonstration before their eyes daily, that they do grow; so

little are the masses of the people accustomed to observe and consider insects with reference to the different stages of their development. But, it nevertheless is strictly true, that insects do not grow after they have emerged from the intermediate or pupa state, whether they have wings or not. They not only do not increase in size, but they acquire no new instincts, nor do they acquire any new colors or new beauties; but, on the contrary, many of them almost immediately after their final transformation begin to lose the colors and beauties they originally had.

In conclusion, we may state that where we have used the terms locust and *true* locust, we do not allude to the insect which has wrongly received the popular name of *locust* in the United States, and which we have denominated a *false* locust. We allude to what is popularly called a grasshopper. There seems, however, little use now in explaining the distinction between true and false locusts, because the minds of the masses seem set in a wrong direction on that subject, and it is questionable whether they will ever get right on it. If a knowledge of the distinction and compliance therewith were made the basis of salvation in this Union, hardly one in a thousand could possibly be saved.

WHERE THE POTATO BUGS GO.

Now that the potato bug is disappearing from Lancaster county, the following item may be of interest: A party of gentlemen fishing near the middle of Long Island Sound, saw great quantities of potato bugs covering the surface of the water as far as the eye could reach. Every floating article, as well as the water, was packed with them, and many were clinging to eel grass and seaweed under the water. The wind was blowing from the south, and had probably carried them from the island, and they were being wafted toward the Connecticut shore. Inland on the island the bugs appear to be increasing in numbers, and the potato vines being dry, they have attacked the egg plants, pepper plants and tomato vines.

The above is near akin to our own observation and experience, as to "Where the Potato Bugs Go." We spent the last week in July, 1875, on a fishing excursion to the "Delaware Breakwater," in the lower end of the State of Delaware, and while there we took occasional strolls along the beach in search of objects of *vertu*. On one occasion our stroll was prolonged to some six or seven miles along the Atlantic beach—from the Light-House to the "Beacon," on the extreme point of Cape Henlopen. Among other things we picked up many specimens of Coleopterous, Neuropterous, and Hymenopterous insects, that had been cast in a waved line on the beach for nearly the whole distance, and among these insects, by far the most numerous, were the "Colorado potato-beetles." We are quite sure there was not a potato field within three miles of the farthest outward point, nor was there any intervening spot that exhibited any thing but sand, pebbles and weather-worn shells—except here and there tufts and patches of tough and wiry grass, but no beetles were found upon them. Some of these beetles were still alive, but most of them were dead, and every succeeding wave that lashed the beach brought in scores of insects. There were twice as many potato-beetles as all other kinds put together. They evidently had been eastward bound, dropped into the ocean, and were brought back by the returning waves. We may infer also that many never reached the shore again from which they had made their departure, but were gobbled up by the fishes that sometimes plentifully inhabit those waters. Nor is this all: some distance up the Bay, and near the town of "Lewes," there is a trussel work—called the "Pier"—which extends a quarter of a mile out into Delaware Bay, upon which is a railroad track, upon which the cars of the Junction railroad daily run to discharge their cargoes into sailing vessels and steamboats that periodically leave the outer

end of the pier for New York, Philadelphia, Boston, Baltimore and other points. In the morning and the evening, when less commercial activity reigns, the pier is esteemed a capital place to fish. Well, all along this pier, from the shore to the extreme outer end, the ubiquitous potato-beetle was present, and at the outer end far more numerous than nearer shore. The State of Delaware at the time was full of these beetles, from one end to the other. The fruit-growers were shipping their peaches to market, and every cargo brought down from the interior also brought down a goodly number of the beetles, and it is not at all surprising that they should be carried aboard of the waiting vessels and transported to other parts of this country, if not to Europe. Still the Atlantic coast is their eastern limit, except the few that may effect a clandestine passage to other localities on board of the coasting vessels. They seem to be all eastward bound; therefore, the farmers occupying a belt of a few miles wide, running parallel with the Atlantic coast, are likely to have their hands eventually full of them, unless they wage a vigilant and exterminating war against them. They do not seem to be content with this belt, hence they drop into the ocean and perish.

Although the Colorado potato-beetle appeared in greater numbers early last spring than they did at any former period since their advent into the county of Lancaster, yet the general crop has suffered very little, comparatively, either in quantity or quality. Early vigorous hand-picking, and later applications of Paris green, proved effective extinguishers of them. When farmers, heretofore defiant or indifferent, came into town and purchased ten to twenty pounds of the best Paris green at a time, we felt that their action "meant business," and the result has been a satisfactory one, and no doubt *pays*. Perhaps when the beetles find that they cannot get any farther eastward than the Atlantic coast, and when they have eaten up all that is suited to their taste there—unless they are drowned in the ocean, or greened to death by the farmers in that part of the country—they may take a notion to return to the fertile parts of Pennsylvania; but let them come, our farmers have learned something, and will know how to meet them, if they profit by the *lessons* they have already learned. Under any circumstances, the potato-beetle is coming to be regarded as a permanent condition or fixture in agriculture, that must be provided for as essentially as plowing, planting and cultivating, in order to secure a crop. They are no longer regarded as a mere incidental, that may or may not occur, or can be with impunity neglected. It is sometimes astonishing what importance the subject has assumed, and with what interest the beetles are inquired about—fully as much as that which attaches to the state of the weather, or any other contingency, present or prospective.

POTATO BEETLE PROGRESS.

Reports show that the Colorado potato beetle is committing very serious injury along the Atlantic ocean. The farmers of Long Island more particularly have suffered severely, the insects getting into hot-beds and destroying tomato and egg plants. Last fall, before going into winter quarters, the beetles swarmed on Coney Island and other portions of the coast. Meeting the Atlantic, the first serious obstacle to its eastward march since it left its Rocky Mountain home, this insect will naturally accumulate along the coast, and for a few years will probably be more injurious for 200 or 300 miles north and south of New York, than it has been in any part of the country. It will be well, therefore, for gardeners and potato growers to prepare for it, and to endeavor to co-operate in their work against it. The Paris green mixture (one part of pure green to twenty-five or thirty of some dilutent) is the best and cheapest antidote against its ravages, and experience and experiment have proven it a perfectly safe remedy where cautiously used. Concerted and persistent effort at this season to destroy the first beetles will render subsequent work all the easier.

THE BIRDS AND THEIR USES.

BY S. S. RATHVON.

The subject of birds and their relation to agriculture has an importance which is not generally appreciated, but which is being enforced by havoc which is being worked by insects where birds have been destroyed. A Richmond (Va.,) paper recently stated that bad news came from every tobacco growing district of the State, the plants being eaten by the fly. Thus, in the opinion of the paper, the chief staple of a large part of Virginia was in danger. This special peril to the Virginia tobacco crop has grown within the last twenty years. It is believed that one of the chief causes is the destruction wrought of late years upon the birds. With the end of the war an indiscriminate hunt for birds has begun, and ever since has been continued. The greatest enemy of insect life is the bird, and as the birds have been destroyed in Virginia, every one has noticed the increase of insects that attack the crops. The same lesson has long been learned in other countries, so that it has become an accepted maxim in Europe to foster the birds, and in Australia, and of late in this country, European birds have been imported for the simple purpose of insect destruction.

In the report of the Commissioner of Agriculture there is an article from the pen of Prof. George H. Perkins, of Vermont, in which he says that there are in the State of Vermont probably not less than eight hundred species of lepidopterous insects, (i. e., the moth and butterflies,) and in the whole United States there are not less, probably, than four thousand. But leaving the rest of the States, Prof. Perkins confines himself to the following calculation to Vermont, and works out the following alarming results:

"If we suppose the number of species in this State to be eight hundred, the increase will be something like this: Each female lays on an average 350 eggs—but we will place the number at 300. Now suppose in the year 1871 there exists only one pair of each species, there would be during the year 240,000 eggs produced, which would develop into 240,000 caterpillars. If half of them were females, next year we should have 120,000 pair of insects, which would produce 36,000,000 caterpillars for 1873, and so on, so that in five years there would come from the unchecked increase of only one pair of each species 1,215,000,000,000,000 of caterpillars, or 200,000,000 for every single acre in the State. It is true that as the arrangement of things now is, not one in a hundred, if indeed one in thou-

sands of these eggs ever reach maturity, but the great agents of destruction are the birds. Making all possible deductions on account of all destructive influences, except the birds, we have left a very large figure, and if this is multiplied by the number of pairs actually living, and as all know of some kinds there are thousands, the product is something appalling."

If such are the facts in Vermont, where a cold climate tends to harass and diminish insect life, what must be the innumerable hordes of insect depredators under warmer and more genial skies? If any of the animal creation, by its relation to the general economy of nature, deserves to be protected, it is the birds. For every apparent evil in nature the Creator has provided a remedy, and birds are the insect destroyers. The remedy is one in which all can have a share in rendering effectual. Farmers and planters should exert themselves to protect the birds from the senseless, savage and worse than useless slaughter to which they have been condemned. These little beings not only minister to the solace of man by their beauty and melody, but they are even more useful than they are beautiful.

The foregoing we clip from the columns of the Baltimore *Sun*; and to illustrate the pecuniary loss sustained by certain districts of our country, on account of the fearful increase of destructive insects, we quote the following from the "Eighth Annual Report of the Noxious and Beneficial Insects of the State of Missouri," by Prof. C. V. Riley, the State Entomologist:

"To enumerate by counties, the following figures approximate the real loss sustained from the injury to grains alone:

"Atchinson, $700,000; Andrew, $500,000; Bates, $200,000; Benton, $5,000; Buchanan, $2,000,000; Caldwell, $10,000; Cass, $2,000,000; Clinton, $600,000; Clay, $800,000; De Kalb, $200,000; Gentry, $400,000; Harrison, $10,000; Henry, $800,000; Holt, $300,000; Jackson, $2,500,000; Jasper, $5,000; Johnson, $1,000,000; Lafayette, $2,000,000; Newton, $5,000; Pettis, $50,000; Platte, $800,000; Ray, $75,000; St. Clair, $250,000; Vernon, $75,000, and Worth, $10,000.

"The foregoing estimates exceed the amount of $15,000,000. They are arrived at, in the majority of instances, by combining the following elements: The number of acres of crops destroyed; the average amount of the crop, and the value of the crop, allowing forty cents a bushel for corn, one dollar for wheat, one dollar and a-half for barley, and thirty cents a bushel for oats. The amount of loss redeemed by crops that succeeded after the insects left, it is impossible to determine; and yet this amount may again be offset by the injury, both temporary and permanent, to fruit, fruit trees, vineyards, gardens, meadows and pastures, by the fact that such crops as flax, castor-beans, &c., have not been estimated in the calcu-

lation; and lastly, by the injury to stock, the animals necessarily driven out of the country, and the general depreciation of property."

The foregoing has relation to a single species of insects, namely: The "Rocky Mountain Locust," (Grasshopper) and there are hundreds of others that multiply as rapidly and are almost, if not quite, as destructive.

Now, although it might be quite difficult to demonstrate satisfactorily in what manner birds could affect the increase or decrease of these and many other insects, yet it has been stated as a remarkable coincidence, that since the wholesale destruction of the wild animals of the great west, especially the feathered tribes, there is, comparatively a greater increase, and a more frequent occurrence of destructive insects. Be this as it may, taken as a whole the beneficial qualities of birds, and especially the insectivorous birds, are altogether unquestionable. Sufficient allowance is never made for the benefits derived from birds early in the season, and before there is anything in the way of fruit and vegetables for them to destroy. Moreover, many species that do not generally appropriate insects as food for themselves, yet invariably feed their young upon them. Indeed, there is hardly an order or a family of birds that are not, either directly or indirectly a benefit to the vegetable world, not excepting even the carniverous species. Our eyes are in a measure shut to the constant operations of the feathered tribes, and if they destroy a single female insect, or the larva of the same, which, during the course of the season would have been the parent of thousands, they illustrate in a most forcible manner how much "an ounce of prevention is worth more than a pound of cure," and also illustrate that with our eyes thus closed, it is impossible to tell what an elephant is like, by only feeling his tusk or his tail.

It is true, where there is a redundancy of birds and a paucity of insects, the former must have a living and to obtain it, they will appropriate a part of the crop which they have helped you to save. If the naked questions were "Birds," or "No Birds," the matter would be easily decided and quickly, for with no birds at all, this world would soon be a bleak and barren waste, altogether unfit for human beings to dwell on.

THE TOMATO OR "LOVE APPLE."

(Lycopersicum esculentum.)

BY H. G. GLASSPOLE.

The Tomato or Love Apple, is the fruit of a herbaceous plant, having a hairy stem, and rank smell; belonging to the Nightshade and potato family, nat. or *Solanaceæ*. It is a native of South America, whence it was early introduced by the Spaniards into Europe, and used as a vegetable. The editor of the *Bongardinier* (pour l'an 1818) describes the tomato as coming orginally from Mexico, but Mr. Sabine, in a paper he read on this plant, before the Horticultural society in 1819, said that there is no authority for this statement, for though Hernandez, in his History of Mexico, mentions it, he does not particularly distinguished it as a native of that country. South America being the native country of this vegetable, it was of course unknown to the ancient Greeks and Romans; still the name Lycopersicum is stated to have originated with Galen, the celebrated physician, who lived about A. D. 131, but it has not been ascertained to what plant it was given. The name is derived from *lykos*, a wolf, and *persicon*, a peach, implying that the fruit was of such inferior quality as to be fit only for the use of that animal. Gesner, an eminent physician and naturalist of Zurich, born in 1516, entered into some investigation of Galen's on the subject, but they did not lead to a certainty, and his opinions are criticised by John Bauhin Anguillara, an Italian, in a work published in 1561, conjectures that the Lycopersicum of Galen was the tomato, and on this authority it is said to have acquired in after-times the name of Lycopersicum Galeni. In the *Adversaria* of Pena and L'Obel, published in 1570, it is called *Poma amoris*, *Pomum aureum*, and *Lycopersicum quorundam*, in conformity with Anguillara's conjecture.

In the "Elemens de Botanique" of Tournefort, 1694, we find he adopted Lycopersicum as the name of the genus in which he placed the particular plant now treated of. Dodoens, a Dutch botanist, described this plant as grown in his time in the Continental gardens, (see his "Pemtades," published at Antwerp, 1583,) and that the fruit was eaten, dressed with pepper, vinegar and oil. It appears by the "Hortus Kewensis," to have been cultivated in England in the year 1596, but it must have been introduced some years previously to that date, as Gerard mentions it in the early part of his voluminous "Herbal," (published in 1597,) which must have taken some years in compiling and printing.

This author calls the tomato *Romum amoris*, and says: "Apples of Love do grow in Spain, Italy, and such hot countries, from whence myself have received seeds for my garden, where they do increase and prosper." He also tells us that "there hath happened into my hands another sort very notable with the former, only the fruit thereof is of a yellow color." Parkinson, in his "Paradiseis," published in 1656, says that "the tomato grows naturally in the hot countries of Barbary and Ethiopia, yet some report them to be first brought from Peru, a province of the West Indies. We only have them for curiosity in our gardens, and for the amorous aspect or beauty of the fruit." There is no record when this vegetable was first employed as an esculent in this country, but Miller, in his "Gardeners' Dictionary," published in 1752, after describing them, says "they were much used in soup in his time." Being a native of hot climates, the crop very much depends on the season in this country; when it is favorable large quantities are produced in the open air. As far back as 1818, being a very fine summer, the growth of this vegetable around London exceeded the demand. Mr. John Wilmot, of Isleworth, states that from a crop of 600 plants that season he gathered 400 half-sieves. The fruit on several single plants probably weighed 40 pounds; some of the apples were of an extraordinary size, exceeding twelve inches in circumference and weighing twelve ounces each.

It is stated that this vegetable, medicinally considered, is an excellent substitute for calomel, and can be taken when that valuable medicine cannot, and with less injury to the constitution. [See M'Intosh's "Book of the Garden."] In France and Italy whole fields of this plant are cultivated. So great is the demand in some parts of the latter country that there is scarcely a dinner served up in which it does not in some way or other form a part. In England the plant is more cultivated than formerly, and there has been of late an importation of this vegetable from the United States, preserved in tins. In the course of an extensive series of chemical experiments on plants by E. Solby, he found that the leaves and stems of the tomato contained nitric acid. It is stated in the "Gardeners' Magazine," vol. x, (1834,) that tomato buds may be grafted on potatoes, and plants thus treated produce good crops of both vegetables.

The old European botanists wrote the name of this plant Tumatle. The Spaniards and Portuguese call them Tomates, which appears to be the original Peruvian appellation; and in Mexico this and several plants of the Solanum genus are called Tomatles.

There are several varieties of tomatoes known by the form and color of their fruits. Duval, in his "Natural History of the Solanum," notices their distinctive characteristics, and describes each as a distinct species; but it is believed that they can all be referred to a common type, viz: the

large tomato, with deeply-divided, rough, hairy leaves, and clusters of yellow flowers, succeeded by large lobed fruit of an orange red or scarlet color when ripe. Dr. B. Seeman, in his "Flora Vitiensis," or the description of plants in the Fiji Islands, mentions *Solanum anthropophagorum*, (the cannibal's tomato,) called Bogo dina, being one of the plants which Fijians cultivate very near Bure-ni-sa, or strangers' house, where the bodies of the slain in battle are always taken to be feasted with the fruit of this plant, and from which it appears that savages sometimes require a *relish* with their disgusting food.

CHINESE AGRICULTURE.

LIEBIG'S LETTERS ON MODERN AGRICULTURE.

I will show the teachers of agriculture another people, who, without the aid of science, of which they know nothing, have found the philosopher's stone, which these very teachers, in their blindness, vainly seek. I will point out to them a land, the fertility of which has for three thousand years never decreased, but, on the contrary, has been ever on the increase; and where more men are crowded together on a square mile than are to be found on the same space in Holland or England.

According to the testimony of all reports of our own and former times, made by Davis, Hedde, Fortune, and others, and which have been fully borne out by the special inquiries into the state of Chinese husbandry, instituted on the spot at my request, by the direction of the late Sir Robert Peel, it appears that in China, nothing is known of *meadow culture* or of *fodder plants*, which are grown for the sake of cattle. *Farm-yard manure* is equally unknown; every field yields *produce twice a year* and is never allowed to lie *fallow*.

Wheat often produces one hundred and twenty-fold and upwards (Eckelberg;) and a fifteen-fold crop is considered an average yield (Davis.) All those means which the German teacher of agriculture regards as *indispensable* for increasing the produce of our fields, and instructs his followers to employ, are not only *entirely* dispensed with by the Chinese farmer, but he actually obtains, without their co-operation, crops which exceed more than two-fold those of the German high farmers.

I readily admit that the Chinese are differently circumstanced from what we are in Europe. Most of them are Buddhists, and eat no beef; we eat more flesh, and must consequently grow fodder for the production of that article of our diet. But that is not the question before us, but one which concerns those principles that are to guide the practice of husbandry. Our teachers of modern agriculture do not tell us to grow fodder, that flesh may be produced, but that we ought to do so for the purpose of forming manure; which clearly shows that they have no just conception of the true nature and aim of agriculture, and that they are altogether ignorant of scientific principles in the matter.

In laying down a scientific principle, the first point for consideration is not whether the application of it will turn out profitable or not, but whether it is *true;* for if it is a true principle it *must* prove advantageous.

In scientific agriculture, "manure" finds no longer a place, for the notions that were formerly attached to the term are completely obsolete; just as is the case with the word *Phlogiston*, which, up to the end of the last century, was used to explain chemical phenomena.

So long as the nature of Phlogiston was unknown, that word served as a collective term to connect together, in an intelligible form, a number of *unknown* operating causes; but when it had once been settled what "Phlogiston" really meant and represented, the term had to give way to more correct ideas, and interpretations of phenomena became what they had never been before, viz: real and trustworthy. Wood does not, on that account, burn differently now-a-days from what it formerly did; the air played the same part in its combustion then as now; and water still possesses the same property of making bodies wet; but what immense progess has been made by mankind, as the result of substituting for the word "Phlogiston," the proper conception of the nature of air, of oxygen, and of the process of combustion!

A similar progress, but much more important, and infinitely more beneficial to man, will spring from a correct apprehension of the process of nutrition in plants and animals. Absurd as would now be the attempt of a teacher of chemistry to account for any chemical process by having recourse to Phlogiston, it is no less inadmissable in a teacher of scientific agriculture to explain a given fact by attributing it to "manure;" for, in the place of the obsolete notion of "manure," *which has no longer any meaning*, we have now for every plant certain positively known *elements of food*, to the united action of which we have to look for an explanation of the fact or phenomenon in question.

The doctrine which inculcates as necessary for the cultivation of the land, the production of manure by green crops, and along with this the maintenance of a stock of cattle, is erroneous.

It is necessary here to distinguish between *necessity* and *utility*. A stock of cattle may prove very useful to the farmer, and yield him a remunerative return in butter, cheese and meat; but this is quite a distinct affair from the tillage of his fields, and he ought to know, and must be taught, that there is absolutely no compulsion upon him to keep a stock of cattle.

The keeping of cattle is necessary for the production of manure, but the production of manure is by no means necessary for the fertilization of corn fields. In the system of the rotation of crops, *all that is required is*, that green crops should be grown, and that their constituent parts be incorporated with the arable surface soil of the field; and it is quite immaterial for the cereals, whether the green crops be previously eaten by the cattle and converted into manure or not.

If lupines, vetches, clover, turnips, &c., are cut up and ploughed in, in the green state, their action is far more powerful.

There is no natural connection of mutual dependence between the production of corn and that of flesh and cheese; on the contrary, they interfere with each other, and must in science be considered as perfectly distinct and separate things; for the production and sale of flesh is carried on at the expense of grain, and *vice versa*. We cannot do without meat, milk, or cheese; and if the production of these articles be left entirely to the grazier, who, on his part, ought to meddle as little as possible with the growing of grain, both he and the farmer, as well as the consumer, would profit by it. In England this separation of the two pursuits is gradually gaining ground; and when, as is to be hoped, our German farmer shall have succeeded, in the course of time in mastering the multiplication table, we may expect that the same separation will take place in Germany. Chemical manufactories are not established anywhere and everywhere, but only in localities offering certain natural advantages; and agriculture, after all, is simply an industrial pursuit, like any other.

In China they know nothing of the fundamental principles upon which German agriculture is based. Except green manuring, they neither know nor esteem the application of any kind of manure beyond the excrements of man. The other matters occasionally employed by them to increase their crops, are in quantity and effect utterly insignificant, when compared with the use of human excrements.

It is quite impossible for us in Europe to form an adequate conception of the great care which is bestowed in China upon the collection of human excrements. In the eyes of the Chinese, these constitute the true sustenance of the soil (so Davis, Fortune, Hedde, and others tell us,) and it is principally to this most energetic agent that they ascribe the activity and fertility of the earth.

The Chinese, whose house is still, what it most probably has ever been, a tent, only that it is built of wood and stone, knows nothing of privies as we have them in our country; but, in their stead, there are found in the principal and most comfortable part of his dwelling, earthenware tubs, or cisterns most carefully constructed of stone and lime; and the notion of utility so completely prevails over the sense of smell that, as Fortune tells us ("The Tea District of China and India," vol. I., p. 221,) "what in every civilized town in Europe would be regarded as a most intolerable nuisance, is there looked upon by all classes, rich and poor, with the utmost complacency, and," he continues, "nothing would cause greater surprise to a Chinese than to complain of the stench arising from these receptacles" The Chinese do not disinfect this manure, but they are perfectly aware that

it loses part of its fertilizing power by the action of the air, and they, therefore, take great care to guard against evaporation.

Except the trade in grain, and in articles of food, generally, there is none so extensively carried on in China as that in human excrements. Long clumsy boats, which traverse the street canals, collect these matters every day and distribute them over the country. Every coolie who has brought his produce to market in the morning, carries home at night two pails full of this manure on a bamboo pole.

The estimation in which it is held is so great that everybody knows the amount of excrement voided per man in a day, month, or year; and a Chinese would regard, as a gross breach of manners, the departure from his house of a guest who neglects to let him have that advantage to which he deems himself justly entitled in return for his hospitality. The value of the excrements of five people is estimated at two Teu per day, which makes 2,000 cash* per annum, or about twenty hectolitres, (440 galls.,) at a price of seven florins.

In the vicinity of large towns these excrements are converted into poudrette, which is then sent to the most distant places, in the shape of square cakes, like bricks. For use these cakes are soaked in water and applied in the fluid form. With the exception of his rice fields, the Chinese does not manure the field, but the plant.

Every substance derived from plants and animals is carefully collected by the Chinese and converted into manure. Oil cakes, horn and bones are highly valued, and so is soot, and more especially ash. To give some notion of the value set by them upon animal offal, it will be sufficient to mention that the barbers most carefully collect, and sell as an article of trade, the somewhat considerable amount of hair of the beards and heads of the hundreds of millions of customers whom they daily shave. The Chinese know the action of gypsum and lime, and it often happens that they renew the plastering of the kitchens for the purpose of making use of the old matter for manure —*Davis.*

No Chinese farmer ever sows a seed of corn before it has been soaked in liquid manure diluted with water, and has begun to germinate; and experience has taught him (so he asserts) that this operation not only tends to promote the growth and development of the plant, but also to protect the seed from the insects in the ground.—*Davis.*

During the summer months, all kinds of vegetable refuse are mixed with turf, straw, grass, peat, weeds, and earth, collected into heaps, and when quite dry, set on fire; after several days of slow combustion, the entire mass is converted into a kind of black earth. This compost is only em-

*100 Cash are equal to about 4½d.—*Fortune.*

ployed for the manuring of seeds. When seed time arrives, one man makes holes in the ground; another follows with the seed, which he places in the holes; and a third adds this black earth. The young seed planted in this manner grows with such extraordinary vigor that it is thereby enabled to push its rootlets through the hard solid soil, and to collect its mineral constituents—*Fortune*.

"The Chinese farmer sows his wheat, after the grains have been soaked in liquid manure, quite close in seed-beds, and afterwards transplants it. Occasionally, also, the soaked grains are immediately sown in the field properly prepared for their reception, at the interval of four inches from each other. The time of transplanting is towards the month of December. In March the seeds send up from seven to nine stalks with ears, but the straw is shorter than with us. I have been told that wheat yields one hundred and twenty-fold and more, which amply repays the care and labor bestowed upon it."—*Eckeberg, report to the Academy of Sciences, at Stockholm*, 1765.*

In Chusan, and the entire rice districts of Chekiang and Keangsoo, two plants are exclusively cultivated for the purpose of sowing as green manure for the rice fields; the one is a species of Coronilla, clover is the other. Broad furrows, similar to those intended for celery are made, and the seeds are planted on the ridges in patches, at a distance of five inches from each other. In the course of a few days germination begins, and long before the winter is gone, the entire field is covered with a luxuriant vegetation. In April the plants are plowed in, and decomposition soon begins, attended with a most disagreeable odor. This method is adopted in all places where rice is grown.—*Fortune, vol.* 1, *p.* 238.

These extracts, which, from want of space, cannot be further extended, will probably suffice to convince the German agriculturist, that his practice, when compared with that of the oldest agricultural nation in the world, stands somewhat in the position of the acts of a child to those of a full-

*The *Dresden Journal*, of 16th September, 1856, contains the following statement: "As we are informed from Eibenstock, forest inspector Thiersch, of that place, has for several years past made very successful experiments in transplanting winter corn in autumn. He transplanted the young plants intended for the purpose, in the middle of October, one peck of seed corn to one hundred square rods of ground, which produced an uncommonly rich crop. There were roots from which sprung as many as fifty-one stalks with ears, and the latter contained as many as 100 grains"

I have applied to Mr. F. J. Thiersch for more precise details of his experiments, and from his statement as to the cost of the operation and the return made, there appears to be no doubt that the Chinese mode of husbandry might also be resorted to with advantage in Europe, in localities where the land is rich and labor abundant. One of my friends who visited M. Thiersch's experimental field, told me that he had counted twenty-one stalks with full ears on a plant pulled up at hazzard, (not picked out.) For poor fields this method of cultivation is entirely unsuited.

grown and experienced man. The Chinese system of husbandry is the more remarkable, if we take into account what they have achieved in other mechanical and chemical pursuits, more incomprehensible, as they owe everything to the purest empiricism. For the Chinese system of instruction has, for thousands of years, so thoroughly excluded every inquiry after an ultimate cause of things, which might possibly have led to the discovery of scientific principles, or to the establishment of a science, that the capability of making further progress, except by imitation, would seem to be destroyed to the very root in that people. The study of the physical laws which has led European nations to the invention of the steam-engine, and of the electric telegraph, and has enabled man to control and turn to his account the forces of nature in numberless other instances, is a matter of absolute impossibility to the Chinese scholar. It is the express command of their first and most ancient teacher of religion, Confucius, that the student shall never allow any thought to arise in his mind but such as he finds written in his books.

It is quite true that what suits one people may not on that account suit all countries and all nations; but one great and incontrovertible truth may at all events be learned from Chinese agriculture, viz: that the fields of the Chinese cultivator have preserved their fertility unimpaired, and in continued vigor ever since the day of Abraham, and of the building of the first Pyramid in Egypt.* This result we also learn has been attained solely and simply by the restitution to the soil of the mineral constituents removed in the production; or, what amounts to the same thing, that this has been effected by the aid of a manure, of which the greater portion is lost to the land in the European system of civilization.

*Vessels of Chinese porcelain are found in the pyramids of the same shape, and with the same characters of writing on them, as are made in China at the present day.

HEREDITARY INFLUENCES.

FROM FOREST AND STREAM.

There are probably few persons now living who have paid the subject any attention, who are not inclined to attribute to the influences of inheritance many more characteristics than were formerly assigned to that source. Less is heard of the term "instinct" and more of the term "hereditary." It has been seen that much of that which we call intuitive in animals and men, is only the same knowldge, perhaps a little exaggerated, as their parents possessed; and when, as in the case of the cave swallow, we know the origin of certain habits which are now just as much innate in the young as others, the origin of which is lost, we are inclined to consider all instinct, so-called, but the sum of inherited experience. The parent transmits to the young not only its general form and external appearance, and not only its specific mental likeness, but also those peculiarities which distinguish it as an individual, and, to a less extent, those traits which it has acquired during its life. Instincts are habits fixed by hereditary transmission and are unconsciously obeyed, and this rule admits of few exceptions. Pointer pups taken into the field, unaccompanied by older dogs, will stand with muscles strained and eyes fixed at the first partridge they see. The young shepherd dog shows a disposition to guard stock. All spiders construct webs, yet each variety constructs its web peculiar to itself. The dog not only inherits scent, but also that which enables him to know a definite kind of game. Certain races of Indians also inherit scent, and so do negroes. Dr. J. S. Bailey mentions a family of negroes who inherited this faculty in a remarkable degree. No matter how stealthily a white person approached their cabin at night, their conversation would immediately be hushed, and they would discover his approach by their scent.

But besides this, changes in the manner of life, habits made necessary or caused by new conditions and environment are transmissible; and here enters that wedge of variation which seems to have been instrumental in producing the present diversity of form among animals and plants. Before the settlement of this country all the swallows nested in hollow trees, in caves, and under the ledges of rock, as they yet do in the far west, and in the remote forests of the British provinces. But when farmers began to till the land, and to keep cattle, and erect houses, the swallows, probably at first attracted by the greater number of insects, seized upon the outhouses and chimneys as more suitable places for building their nests, and

have gradually abandoned the woods in the settled parts of the country altogether. Their young have not gone back to the woods and caves—although some of the first generations may have done so—and have little by little modified the shape of the nest to suit the situation, until there is a very great difference between the nests built in our barns and those built by the wild birds of the same species in the Rocky Mountains.

It was long ago found out that certain advantageous traits in horses and cattle could be perpetuated and augmented, the power to make these peculiarities more lasting and more prominent increasing with each generation. Examples of this are numerous and known to every breeder, and it is upon the faculty of inheritance, under advantageous conditions, that Mr. Darwin hinges his doctrine of evolution by natural selection. But, not only do good features perpetuate themselves, but evils and deformity also come under the influence of inheritance, and are the surest of all to descend from generation to generation. Even those deformities that arise from artifice or accident are transmissible. Many Indian tribes of Peru, and some of the Oregon coast, had peculiar modes of distorting the heads of their children, and now many children are born with their heads out of shape in the peculiar way. Esquimaux sledge dogs and Maux cats usually have to suffer the loss of their tails, and their puppies and kittens are often born tailless; and in rare cases the loss of a limb in men has resulted in their children having but one arm or leg. Blindness, deafness, insanity, idiocy, and morbid appetites are all inherited, and statistics abound to show the extent to which this influence has tainted the human race.

In view of these facts, which recent investigations have brought to light, the study of the heredity of disease, in their relation to mankind, becomes one of the deepest interests and importance. To a thoughtful man, it is fearful to consider how unwittingly men are daily sowing seeds of disease and infirmity in their frames, which, once rooted, can never be eradicated, but which will re-appear again and again in one form or another. No man may contract asthma, rheumatism, gout, consumption, or any disease which affects his blood, through carelessness or whisky, or any other form of dissipation, and plead that it hurts himself alone. If he have children he surely curses them with an infirm constitution, and opens an ever-broadening, ever-deepening channel for a new stream of misery to flow through the world. Our insane and idiot and inebriate asylums, our hospitals for consumptives and scrofulous patients, even our prisons are witnesses of the certainty of this result. It has been said that there never now occurs—no such thing is recorded in recent times—an original case of syphilitic disease. This may be too strong a statement, for some physicians doubt its truth; but it is certain that hundreds of innocent families bear in their systems and faces to-day the living, loathsome marks of their remote fore-

fathers' vices, who are not aware of the fact and cause of their suffering. Not alone does the good men do live after them. The iniquities of the fathers are visited upon the children even unto the third and fourth generation. For any one who cares for his race or his children, could there be a stronger argument for leading a pure, wholesome, careful life, than these facts contain?

[Analagous to the same subject, only on a higher plane, is the following from the editorial columns of the *Public Ledger*.]

REPRODUCTIVE FORCE.

There is nothing more wonderful in life than its reproductive force. Everything which has in it the element of growth has also the power of creation. Every organism, from the humblest blade of grass to the most illustrious man, is not only living its own life, but impressing it upon myriads of other similar existences, and this not by any intentional action of its own, but by an inevitable law of its very being. In the simpler forms of life this transmission of self appears to be chiefly in the direction of propagation. The plant lives its individual life, and drops its seeds, which springs up into similar organisms. As we rise higher in the scale, however, we notice that this reproductive force is widened in its action. The bird not only lays its eggs, but cherishes its young, and doubtless maintains some degree of social influence upon its feathered mates. But it is reserved for man to exercise this power in the fullest and broadest sense. He reiterates himself, not only in his children but in all with whom he comes in contact. He impressed not only his physique upon a few, but his character upon the many. There are births of conduct going on continually, and each one of us is a parent. As the sun sheds unconsciously its light and heat, and makes all things within the range of its influence in some degree like itself, so we shed our dispositions and qualities upon one another, and transform them in some degree to our own image.

This influence is something quite apart from any voluntary and intentional action. We often deliberately set to work to produce some change in our friends or in society at large. Perhaps we work hard to improve a man, to educate a child, to promote a reform or to break up a vice. We may bring all our powers to bear upon the matter in hand, we may set other influences in operation, we may descant eloquently upon the advantages of one course and the evils of the other; nay, we may even call to our aid all the restraints of the law and the rewards of public favor, and with it all, we shall not accomplish so much as will a single, good and pure life by its mystical attraction. The one is artificial, spasmodic, noisy; the other is natural, constant, quiet; the one is like medicine given to counteract some evil, the other is like a pure and bracing atmosphere entering into the lungs and giving new vigor and tone to the entire system.

Take the child from its earliest years—how is its character built up, its disposition engendered? Partly no doubt by the parents' active and earnest labors and precepts, but much more largely by their lives. The opportunities they have for deliberately instructing him are a mere nothing compared with those that he has for observing their conduct, drinking in their opinions, and finding out their real desires, feelings and aims. He is told, for instance, of the sacredness of truth and the sinfulness of deceit, but if he sees those around him practicing small artifices, if he hears unfair transactions recounted as good jokes, if he is himself duped and misled by insincerity, how much will the moral lectures affect him? They will but add another instance of duplicity and strengthen within him the spirit of dishonesty which he is constantly absorbing.

The same thing is going on everywhere, and with every one. We are all continually and inevitably influenced by the lives of those around us. It is not that we copy them, but that we unconsciously absorb them. We are, as it were, pouring our natures into each other all the time without thought or retention. The stronger the nature the more potent is its magnetism. The closer we approach to the sphere of another the more we partake of his character. Patience, courage, hope and enthusiasm are not taught but infused. They are transmitted by an electric current that no power of ours could create and certainly none could destroy.

We can never fully estimate this reproductive force. Not only every action but every thought, feeling, desire and aim is full of potency upon others. They are constantly being shared and are ever writing their impress on the characters of those with whom we mingle. We are always either lifting some one up or drawing him down to our own level. An atmosphere of some sort is always emanating from us and permeating others. Is it pure or corrupt? Are we infusing the spirit of justice, truth and love, or of selfishness, deceit and hatred? Are we instilling the habits of industry, temperance and frugality, or of idleness, sensuality and extravagance? As the fountain is so will be the stream. If we would know what influence we are shedding we have but to examine our most cherished thoughts, hopes and purposes. We may fancy them hidden in our own breasts, but it is not so. They are all at work reproducing themselves in countless forms in the hearts of others, and building up their characters for good or for evil.

ABOUT MUSHROOMS.

BY J. STAUFFER.

My esteemed friend, H. M. Engle, a few weeks ago, brought me a fungus to name, stating that it would be desirable to have a reliable mark to distinguish those that are eatable from those considered poisonous.

In my botanical pursuits I neglected this branch. About twenty-five years ago, happening to spend an afternoon with a friend, contigous to a shady, moist woods, in the latter part of September, my attention was attracted by the profusion and great variety of fungi growing all around, and induced me to sketch and take notes, as well as to collect quite a number, with the expectation that by the aid of the figures and classification in Loudon's Encyclopædia of Plants, I would be enabled to name them.

True, the genera I could determine, but those described being European, I was still at a loss to name our species for want of a list of such known to be natives. I endeavored to get the work referred to by Persoon. A list of 3,043 species of fungi, which came under the observation of Lewis D. de Schweinitz, around Bethlehem, Pennsylvania, and by him communicated to the Philosophical Society of Philadelphia, in 1831. Others have since added to this list from the north. Rev. Dr. M. A. Curtis, in his catalogue of Plants of the State of North Carolina, (Geological Report,) 1867, gives 438 species of Agarics, of which he considers fifty-six as esculent. But, alas! these catalogues are locked up in these societies and cannot be had. Hence, the study with reference to those found and named is barred, and consequently no satisfactory report can be made or definite opinion given.

In an English work recently published, called "The Modern Householder; a Manuel of Domestic Economy in all its branches," by Ross Murray, is neatly executed, with accurate figures of the most useful of British fungi, with descriptions and mode of cooking and propagation. Still they may, and in some respects do, differ from our native species, so that I shall not attempt in this article to treat this subject specifically, but, in a general view, present some prominent facts worth knowing, gleaned from at least ten different sources, in addition to my own observations. The fungi derive their nutriment from the substance on which they grow, and not from the air, as the allied class of Lichens. Mr. Berkley says: "The *Fungi* may be recognized either as the creatures of corruption, *i. e.*, springing from various bodies, whether animal or vegetable, in a more or less advanced stage of decomposition—or as parasites of living bodies, pro-

ducing an injurious change. The ephemeral toad-stools of the hot-bed, the mushrooms of our rich pastures, the sap-balls on decaying trees, the moulds which infest our food, and even the tissues of living animals, the mildew, bunt, and smut of our corn crops, &c., are classified with the fungi, of which there are two great sections, and these divided into natural orders and tribes. A vast number of species are known, and many of these are of great importance to man, either from their useful or their mischievous properties. The mushroom truffle and morel, delicacies well known to the table, and highly prized and extolled by many."

Schwaegrichen, the editor of Schweinuz's first contribution to the knowledge of our North American species, derived great satisfaction in eating those which possessed neither *bad flavor* nor *disagreeable smell*, (the italics are mine) and which had a *tolerably firm* consistency, eaten with bread and drinking nothing but water; such a diet pursued for several weeks, as he affirms, increasing his strength and improving his health. Persoon, who furnishes the foregoing, also says: "I have observed that fungi, if moderately used, are very nourishing." The substance known as "*fungin*" is equally present in those that are harmless or poisonous, and is itself highly nutritious, containing nitrogen; they are very similar to animal matter in their composition, and like animals give out carbonic acid gas, and not like other vegetables absorb carbonic acid from the atmosphere and respire oxygen. It seems the only criterion to judge of quality is smell and consistency of their texture. The flavor is variable, compared in some to the smell of new made hay, some like violets, anise, walnuts, new meal, &c., which are all rather agreeable; others again have an odor so intolerably fetid as to be nauseating. With regard to form, color and general features, some edible species cannot be distinguished from the magnificent species of the *Amanita (Agaric) Muscarius*, the Fly Agaric of Europe, and found in our woods. The Czar Alexandria lost his life by eating of it, and yet we learn that in Kamtschatka they are used as an article of food, and also to keep up a drunken frolic, the intoxication being similar to that produced by the *haschisch* and *magoon* in the East. Thus we learn that while the same species are used as food in Russia, they are condemned in Europe. The Parasol Agaric *(Agaricus procerus,)* often met with, is in *high request all over the continent*, called the king of edible fungi. "Whenever an agaric on a *long stalk*, enlarged at *the base*, presents a *dry cuticle*, more or less *scaly*, a dark colored *unbonated top*, a *moveable ring*, and *white* gills, it must be *Agaricus procerus*, and it may be gathered and eaten without fear, says a good authority. The fungipophagists lament the tons of valuable food wasted through neglect of fungi as articles of diet. Dr. Badham, Dr. Greville, Berkeley, Mr. Worthington Smith, and others, are enthusiastic in their praise. Dr. Badham compares some of them as "beefsteaks" grow-

ing on oaks in the shape of *Fistulina hepatica*. *Agaricus fusipes*, to pickles in clusters under them. Puff-balls, not unaptly compared to "sweet-bread," for the rich delicacy of their unassisted flavor. *Hydna*, as good as oysters, which they somewhat resemble in taste; *Agaricus deliciosus*, reminding us of tender "lamb kidney," the beautiful yellow chanterille, the "*Kalon kai agathon*" of diet growing by the bushel; the sweet nutty "Boletus" in vain calling itself *edulis* (edible,) where there was none to believe; the dainty *Orcilla (Agaricus heterophyllus,)* which tastes like the craw fish when grilled; the red and green species of Agaricus, to cook in any way and equally good in all"—enough to make one's mouth water, and feel like "going for them." Why, the Rev. M. J. Berkeley, the profound author of an extensive work on Fungi, says of the Fairy-ring champignon—the *Marasmius oreades:* "The common fairy-ring fungus is the best of all of them; yet there is scarcely one person in a thousand *who dare venture to use them.*" There are two kinds, however—this has an extremely fine flavor, and makes perhaps the very best ketchup that there is.

The two kinds are chiefly distinguished by the gills; in the first the *M. Oreades*, growing in pastures, gills broad and far apart. *M. Urens*, woods and pasture, gill narrow and crowded together. These latter are to be avoided. To illustrate the uncertainty, I will mention a few cases, because of the prominence of an advocate in the use of fungi for food. Mr. Worthington Smith, the fungologist, to whom specimens of the before-mentioned *Marasmius ereades*, extolled by Berkeley and others, were sent for examination, being of a lot partaken of by a woman and two children at Plymouth, England. Fourteen hours after eating they were seized with symptoms of poisoning; vomiting and purging occurred, followed by delirium in the mother, and convulsions in the children. The children, aged six and thirteen, died three days afterwards, but the mother gradually recovered. Mr. Smith, in full confidence, ate half a dozen after having cooked them. Within an hour or two the usual symptoms of poisoning came on, with burning of the throat, irresistible depression of spirits and disordered stomach, which, fortunately for him, gradually passed off without more serious consequences. Another statement says: Mr. Worthington Smith annually attends the Hereford Fungus Festival, where earnest fungologists have a fungus banquet, and therefore he must be regarded as a judge. Nevertheless this eminent fungologist, with his family, were nearly poisoned by eating another fungus, the *Agaricus fertilis*. The cooked specimens scarcely weighed half-an-ounce, and yet Mr. Smith, his wife and child, suffered severely through it. Mr. Smith states that the gastronomic qualities were excellent, so that the sense of smell and taste afforded no indication of its poisonous qualities. The symptoms in this case were swimming of the head, nausea, vomiting and prostration. Deep but uneasy sleep fol-

lowed, and perfect recovery did not take place for ten days or a fortnight. (A. Smee, p. 359.) If the laudation of some stimulates us to "go for them," such facts are enough to cause us to "stand still a bit and think about it." I may be excusable for declaring with Alfred Smee, that for years I have attempted to discover a test for the discrimination of wholesome from poisonous fungi, but have failed.

And yet when we consider that in some sections they are collected by the quantity and sold at the markets—without hearing of any bad results—there must be a secret somewhere, whether in soil, pabulum, weather, or certain conditions, I shall not pretend to say from my limited experience.

Vinegar, salt, alcohol and cooking properly, dispels a certain acrid volatile principle in *orum, ranunculus,* and why not in fungi. Still there is, nevertheless, in some species a fixed principle that these means will not remove, and therefore cannot be used for food with safety.

On one of my botanical rambles I met, in Mr. Horst's woods, near the Chickies creek, a fungus in a clean grassy spot, in size, shape and color that of a large home-made loaf of bread. I thought this was a monster, and cutting it open I found it of a uniform texture and a rather pleasant odor, and no doubt edible, but I passed it. This, however, is no comparison to the one mentioned by Dr. Greville, found in England, the *Polyporus Squamosus,* which attained a circumferance of seven feet and five inches, and weighing thirty-four pounds after having been cut four days. It was only of four weeks growth, thus acquiring an increase equal to nineteen ounces per day. Dr. Lindley has computed that the cell multiplied at the ordinary rate of *sixty millions in a minute.* This was a similar puff-ball to the one I mentioned, and sprung up during the night to the size of a pumpkin, as stated by Lindley. In the work of F. A. Pouchet, M. D., from the French. "The universe, or the infinitely great and infinitely little," on page 436, is a picture of a boy on his knees on the side of a Gigantic Lycoperdon or puff-ball of one night's growth, copied from nature, and mentions the "feverish activity which must reign in the vital laboratory of those monstrous lycoperdons, nine feet in circumference, of which Bulliard speaks in his *History of Fungi.*"

If my communication is not calculated to give the reader any clear guide to enable him to select edible fungi with any degree of certainty, it will at least give some idea of the difficulty of the task—nor do I believe in giving only one side of any subject. I have long ago learned that to every question there are two extremes, and an old proverb, in the German, says, "Middle mass, ist die beste strass."

MUSHROOM AND TRUFFLE—APPENDIX.

Agaricus campestris—the cultivated mushroom—is so important, in a culinary point of view, that a constant supply is desirable. The culture is

easy when the proper means are used. To grow mushrooms artificially, fresh horse droppings must be obtained from the stables, placed under cover, in an airy shed, till thoroughly dry; when dry these droppings are packed into a solid bed, in a suitable out-house, which will cause the material to heat—care must be taken not to allow it to become too hot, say blood heat—pieces of spawn, which contain the mycelium of the mushroom, about the size of an egg, are inserted into various parts of the bed. This bed must be kept perfectly dry for about six weeks, by which time the mycelium, or long threads of the spawn, will have run through the bed. All this time the bed must be kept dry and at a temperature of about 60° Fahr. In six or seven weeks the spawn has filled the mass; the material may now be gently sprinkled with lukewarm water, but care should be taken not to give too much water, lest the mycelium rot. A few days after watering, little buttons are formed, which in a few hours expand into mushrooms. By carefully following these directions there is no danger of failing to raise a crop. Some recommend covering the bed with loam, but this is not necessary; a cave or cellar is considered of advantage to raise them in. What is called mushroom spawn is usually made of horse droppings, formed into masses shaped like bricks, through which the mycelium is allowed to penetrate. Warmth and moisture promote the growth.

The Morel *(Morchella esculentus)* is highly esteemed in France. The Truffle (Tuber æstivum) ought to be found in the limestone districts, if understood like the truffle-hunters of Europe do, where to look for them, but they train dogs; this they do by placing a truffle in an old shoe and making the dog find it, and make his being fed depend upon it; when he understands once, he soon depends on his scent, and will smell it under the soil; so the dog will when taken out to hunt the truffle in the field smell it and scratch for it. The dog is soon trained. However, before we can train dogs to hunt the truffle we must first find it to train him with, and there is the difficulty, provided we even have them hidden away in our fields and unknown.

TRUFFLES (TUBER CIBARIUM)

Grow a few inches beneath the surface of the soil, which is usually of a dry and light quality, and around the roots of oak and chestnut trees. Collected between October and January, when fully matured they become gelatinous and gradually dissolve, are about the size of a hen's egg, and have no roots or fibrils; the skin is blackish or dark grey, with small projections like warts on it. The flesh is greyish white or blackish with black or brown veins. I mention this, because if such a thing would be dug up, no one would suppose it was the famous truffle, and its discovery even unknown.

WHAT IS BLIGHT?

A good deal is said by the agricultural papers at this time—and also by agriculturists and horticulturists, when in meetings assembled—about *Blight*, its causes and its effects, but mainly its *effects;* for, as to its *causes*, all seem to be at sea without a compass, and therefore all that is advanced is merely conjectural and unsatisfactory. And here at the outset we confess that we feel unable to cheer the aggrieved parties with any information of acknowledged value to them, in reference to the most aggravated form of the blight about which they most complain. First, however, it is essential that we should exactly know what is meant by *blight;* and particularly the kind of blight that may have come under our observation; for, it is very evident, from the manner in which it is described by various persons, that there must be different causes for its manifestation. The dictionary interpretation, or rather definition, of *blight*, is a "mildew; decay; anything nipping or blasting; applied as a general name to various injuries or diseases of plants, causing the whole or a part to wither, whether occasioned by insects, fungi, or atmospheric influences." Also, "a downy species of *aphis*, or plant louse, destructive to trees." "To frustrate; to prevent the growth and fertility of vegetation, as *blighted* corn." And, as the term is now used, it is made to cover a variety of effects, proceeding from a variety of causes; in fact, when a plant or tree becomes enervated, wilted, or withered from any cause, it is said to be *blighted;* mainly because no other name seems to so conveniently cover the case as this term.

In short, without a qualifying adjective or prefix, the term *blight* is about as indefinite as the terms "pinch-bug," or "worm." When the base of a young peach tree becomes seriously infested by the "Peach tree borer," (*Ægeria exitosa,*) causing the leaves to wilt or turn yellow, and giving it a weak and sickly appearance, it is said to be *blighted*, and so it is, but this is of a specific character, and is the effect of a cause that may be readily discovered if we will but make an intelligent effort; and, knowing the cause, we may apply the remedy. This, perhaps, might appropriately be called the "Borer-blight."

When the leaves of peach trees become gnarled, curled and yellowish in color, and the cavities and inequalities caused by their distorted condition, contain the "peachaphis," *(Aphis persica,)* then the tree may be said to be afflicted with the "aphid-blight;" and, knowing the cause, the cure would be in finding something to kill the aphids. But the leaves of peach trees sometimes turn yellow, become curled, crisped, wilted and dry when

no borers are in the trunk or at the roots and when no aphids are on the leaves. In some instances a very minute fungus is present, and then we might properly term it the "Fungus-blight," and when no *fungi* can possibly be detected, if it has been caused by the previous winter's freezing, it might be called the "Frost-blight;" but when it has not been caused by frost it is conveniently called "Fire-blight," about the *cause* of which doctors by no means agree. Fire-blight is variously attributed to climatic causes, electrical influences, or the chemical character of the soil; but just which, what or how there seems to be a diversity of opinion on even among the most experienced in these matters.

All the foregoing causes and their effects are sometimes visible on the apples, the pears, the oaks and other kinds of trees; and this is conspicuously the case in regard to the pear trees the present season. In addition to the foregoing, however, there is a small beetle, which, in both its *larva* and *imago* states, perforates the smaller branches and makes an excavation in the heart, causing all the leaves to become withered, wilted or blacked above the perforation, and this might, by way of distinction, be called the "Beetle-blight." This beetle is the *Tomicus pyri*, and to destroy it would be to cut off the blighted branches a few inches below the blighted portion and burn them. Sometimes the leaves of the pear trees are infested by a "slug" which skeletonize them and gives them a crisp and burnt appearance, and this we might properly name the "Slug-blight." These slugs are the larvæ of a "Saw-fly," *(Selandria pyri,)* and an application of a poisoned powder or solution at the proper time might effect their destruction and cure. But the "Fire-blight" of the pear sometimes occurs so suddenly, so mysteriously and so generally—epidemically as it were—that the cause thus far has been past finding out and the question still is: "What are we going to do about it?" This kind of blight sometimes is confined to one or more small branches; at other times to a large branch, or the quarter or the half, or the greater part of the tree. At other times again (as in the past season) it commences at the top, and taking one branch after another works downward until it finally compasses the whole tree. In the evening the tree may be fair to look upon and on the following morning it may be blighted. This form of blight may be confined to a single tree in an orchard; or others, or nearly the whole orchard, may be more or less infected, but the causes may be the same and as difficult to determine as in the case of the peach tree.

There is at this writing (Sept. 1) two "Horse-chestnut trees," *(Æsculus hippocastanum)* on the south side of Chestnut street, near Duke, in Lancaster city, all the leaves of which, during part of July and August, became crisp, discolored and fell off, without the presence of insects or any other visible cause; and one of these trees, near the ends of the branches,

has put forth new leaves, shoots and flower-buds, so that now it presents the singular spectacle of leaves, flowers and fruit at one period. The blight in these trees is analogous to fire-blight, and probably proceeds from the same cause, whatever that may be. The elm trees of Lancaster and vicinity, and also elsewhere in the county, the present season, have been infested by multitudes of a species of *Galeruca*, which is said to have been introduced into this country from Europe many years ago, and the larvæ as well as the mature insects puncture and skeletonize the leaves, giving such leaves a burnt and blighted appearance.

On the 10th of August we examined some young locust trees on Chestnut Hill, in this county, and we found all the tender growth of the present season infested by large numbers of small "Tree hoppers," (*Smilia,*) which were engaged in sucking out the sap, accompanied by a host of ants, which benefited by the punctures made by the hoppers, or lapped up their excretions. We never before saw the hoppers so abundant; from fifteen to twenty-five were often seen in a group, of various sizes, some of them so very small that they could not be detected without a magnifier, but all were engaged in the work of exhausting the sap of the trees. There is also a small "curculio" (*Apion robinea*) which punctures the leaves of the locusts; but the worst enemies to them are the "Leaf-miners." These penetrate the leaves, eating the *parenchyma*, and leaving nothing but the upper and lower skin remaining. They are both the larvæ of a minute species of *Lepidoptera* and of *Coleoptera*. The latter is the *Hispa suturalis*, and is far the worst. Some years ago we noticed a row of locust trees, about an eighth of a mile in length, nearly every leaf on which was more or less mined by these little insects, which were present in myriads, producing a brownish and yellowish blight, and this prevailed that season in many parts of the county.

When all these contingencies occur at the same time, and the "Locust-tree-borer" (*Clytus robinea*) penetrates the trunks and branches, the trees have a fearful ordeal to pass through, and it would not be very surprising if they should become blighted and die. But these trees sometimes become blighted without the presence of any of the aforenamed external enemies, and no positive evidence of the internal ones, just as is the case of the peach and the pear.

Apple trees are not so subject to fire blight as the pear trees; but when the "Root aphis," the base, the trunk, and the branch borers attack young apple trees, they produce a blight that is more certainly destructive than any other form of the disease. Some years ago, from the "Tower" in Mount Auburn Cemetery, near Boston, we noticed that many isolated apple trees, as well as whole orchards, were more or less browned and blighted, and when we inquired the cause we were informed that it was caused by mul-

titudes of "Canker worms," (*Anysopteryx nernata.*) But apple trees may also be blighted from other as yet unknown causes, and it is the function of those who are always about and among them to make intelligent observations and to record them. "That's what's the matter." Those most interested in these things pay the least attention to them.

Branches of oak and hickory trees often become blighted, and when, subsequently, a storm of wind comes, these branches are broken off and fall to the ground. In the oak tree these blighted branches are caused by a brownish cylindrical beetle—or rather by its larva—called the "Oak tree pruner," (*Elaphidion putator* and other species.) This larva mines through the heart of the branches, and when it has nearly completed its larval period, it gnaws away all the wood at a certain place, leaving nothing but the bark remaining, and then it does not require much of a wind to break them off, the larva usually being found in the fallen branch. From these branches we have bred the above-named species. The "Hickory tree pruners" deposit their eggs in the branches and then girdle them; the winds after a time breaking off the branches, and the young pruner is afterwards developed therein. We have never bred the last named beetle from these pruned branches, but we have detected them girdling them. It is scientifically called *Onciderus singulatus*, and has a family alliance to the "Apple-tree borer," (*Saperda bivittata.*) S. P. Eby, Esq., informs us that an insect of some kind is girdling his Linden trees, near Mountville, and those he brought us present the same appearance as the hickory pruner's work.

Some causes of blight and decay in trees we may be able to account for, but even then we may be at fault for a remedy, much less can we provide one when we are ignorant of the cause. On this subject the following from *Science Gossip* for August, 1876, may contain some suggestions that may be worthy the attention of horticulturists and others:

DECAY OF THE TREES IN HYDE PARK.

In *Science Gossip* for May, 1873, is a memoir on raphides and other plant crystals by Professor Gulliver, F. R. S., illustrated by numerous wood cuts; and he has subsequently given descriptions, with a plate, of the short crystal prisms in various plants, more especially of the order Leguminosæ, in the *Monthly Microscopical Journal*, December, 1873. As to the use of raphides and other plant-crystals, he regards them as valuable manure, to be restored at the fall of the leaf to the earth for the nutriment of the parent plant; and besides to afford at other times important botanical characters, in which respect true raphides are very significant. The report of the June meeting, 1876, of the East Kent Natural History Society, contains some applications of these facts to the sad state of the trees in Hyde Park, so much deplored of late in the newspapers and elsewhere. As if to re-

move the natural food of these trees, their fallen leaves and fruit have for many years been carefully swept away, and no suitable manure substituted. These leaves and fruit are very rich in sphæraphides and short prismatic crystals, consisting chiefly of phosphate or oxalate of lime, the very food required for the preservation of the plant. And indeed every gardener well knows the excellence of leaf-mould as manure; but in no work on botany, or horticulture, or arboriculture, has the main cause of that excellence been explained or even recognized. But now we see how the fall of the leaf is a provision of nature for the welfare of the plant. In such a soil as that of Hyde Park the calcareous salts are especially needed for the preservation of the trees. No wonder, then, when so long and regularly deprived of the fallen leaves and other parts, these trees should show signs of decay, just as beasts would pine and waste if their natural food were taken from them. Had the old forests been always cleared of the fallen leaves, there would long since have been a decay of that noble vegetation which still excites the admiration of the traveler. Rich and deep soils may afford for long periods a sufficiency of calcareous salts for the preservation of the plants, but not so shallow and poor soils. The quantity of saline matter annually taken up even by a single tree from the soil, and appearing as microscopic crystals in the plant is prodigious; and unless this saline material be returned to the earth, exhaustion thereof must sooner or later occur. The Legumens, too, are very rich in short prismatic crystals, and these no doubt in such plants as the trefoils, which are so greedily devoured by cattle, afford an important supply of the calcareous or other salts, which are essential in the animal economy. Has any agricultural chemist ever estimated the quantity, by weight, of the short, prismatic crystals in a truss of clover? They present in the clovers and other trefoils lovely microscopic objects, suggestive, too, of utility. Nor are such observations alone in proving the high value of the microscope in explaining or directing practical operations in the cultivation of useful plants.

If the foregoing extract does not elucidate the subject of blight, or satisfactorily explain its cause, it at least suggests the importance of leaf-mould in sustaining trees and plants, and securing their healthful condition, because the fallen leaves contain the "raphides," or cellular crystals of those mineral salts, which are so essential to the growth of vegetation; a fact that is no doubt more or less apparent to many, without eliciting the practical attention of any. We cannot tell how far we may be injuring vegetation by the continued removal from the soil of those elements which they most do crave. Even in cases of fire-blight, when only a single branch is smitten, we cannot tell how long it may have been in process of that peculiar condition which was necessary for the development and visible manifestation of the phenomenon. It was, 'tis said, the "last straw

which broke the back of the camel," and plants, like animals, may for a long time patiently and tenaciously endure a deprivation and then suddenly break down. Again, trees, shrubs and plants that are in a vigorous state of growth are not so subject to the infestation of insects and fungi as those which have become enervated by reason of the depletion of the soil in which they are growing, or at least do not so readily succumb to these infestations. Some forty or fifty years ago there was no tree in Lancaster county more popular, or more universally grown, as an ornamental tree, than the Lombardy Poplar. Every farm house had them in the yard, and in cities, towns and villages, whole rows of them adorned the side walks. But one by one they became blighted and decayed; first, perhaps, a single branch, then the fourth or half of the tree, and finally the whole body decayed and died, so that now it is rarely that they are seen anywhere; no one knew why or how, and no one seemed to think that the mulching of the soil with the fallen leaves was of any importance in securing it a healthy condition; for the yards and sidewalks where they grew were carefully swept, and kept scrupulously clean.

But it is also the opinion of very respectable authorities that blight is caused somehow through climatic and electrical influences, although they may not be able to explain exactly how. Others again, that a long continued term of intense heat may cause it. The rapid volatilization and evaporation of the sap from the leaves, and especially the new growth of the wood, (the trunk, from the same cause, being unable to supply the abnormal exhaustion,) and the final contraction of the tissues and the pores, thus preventing the normal circulation in the leaves and tender branches, especially when the season is more than ordinarily a dry one. We often see this effect in succulent vegetation, on account of its rapid secretion and luxuriant expiration, by which its equilibrium is interrupted, deranged or destroyed. We also often see (for instance, in long continued hot and dry weather,) the blades of corn, the leaves of clover and succulent vegetation generally, roll themselves up into tubes, or close up their most exposed surfaces, and thus present a dry and shrunken appearance, terminating in withering decay and death. Some also allege that it is the effect of a previous hard freezing winter, through which the sap becomes vitiated. But the mild winter of 1875 and 1876 affords no support to this theory. Notwithstanding the mild winter named, the present has been the worst blight season that we have had for many years.

Verily, a wide field on this "crop" is before us, and it ought to elicit the most competent and persevering explorers, for the subject is drawing unusual attention towards the various forms of blight.

GRAPE PHYLLOXERA.

(Phylloxera vastatrix.)

BY S. S. RATHVON

"It is estimated that damage to the amount of $27,955,000 will be done to the French vineyards this year by a small insect called the phylloxera, which attacks the vine roots and dries up the leaves."

According to the most reliable authority, this insect occurs in two very different forms or phases, so different indeed that there are others who contend that they are two different insects. We have observed it in the tubercular or gall form on the leaves of the Clinton and other grape vines in this county, at various times, during the past seven years. Generally, however, on the Clinton, and other varieties that have originated from the same stock. On one occasion we visited the vineyard of Mr. Reuben Weaver, of Rapho township, not far from the northern boundary, and found all his Clinton vines seriously infested, and none of the others, except here and there a few on the Franklin. Whole rows of the Clinton were infested from one end to the other, from the base to the very ends of the new growth, in some instances hardly a single leaf escaping. Of course, this prevented the leaves from developing and performing their normal functions, and in the same degree preventing the ripening and maturing of the fruit. We recommended the cutting off the infested ends and laterals, and destroying the insects in their ova or larva form. To what extent he followed our suggestions we are not informed, but in no subsequent season were his vines infested as they were on the occasion we alluded to, and this has also been the case in various other localities in the county.

The presence of this minute insect (*Phylloxera vastatrix*) shows itself in vast numbers of irregular, raised tubercles, or galls, on the undersides of the leaves of the different varieties of the grape, and it is especially on those whose leaves are of a delicate texture; and hence, on whatever variety they may appear, they will always be on the tenderest portion, often out to the very ends, where the leaves are imperfectly expanded. These galls are of various sizes, and, of course, in various stages of advancement, and it is wonderful how they succeed in extending their domain so rapidly; for we have noticed them on the young, scarcely half-expanded leaves, at the very end of the vines. On carefully opening these galls at the proper season (during July and August,) they will be found hollow and the interior

cavities filled with yellowish eggs, or young insects, so minute that their forms can only be recognized by the aid of a magnifier. When the young are ready to emerge forth, a fissure occurs in the top of the galls, through which they effect their escape, and thus spread over the vines.

They belong to the great Aphid, or Plantlouse family, and their food is the sap of the vines, and when such countless millions occur as are sometimes on the vines, of course they must greatly enervate them, if they do not entirely destroy them.

But it is not in this form that they are the most destructive, or have been so devastating as they have been for some years in France and other European localities, especially the former. They also occur on the roots of the vines, especially after they have dropped their foliage, and in this form they are the most destructive, for the reason that they are not so accessible as they are when their operations are confined to the leaves. The paragraph we have quoted at the head of this paper is no exaggeration, but rather falls below the real loss sustained by the French grape growers, than rises above it.

The root Phylloxera has also been detected in this country, especially in some of the Southern States, and no doubt where our vines have suffered from invisible causes, it may have been due to the presence of the root form of this insect; and where they are so numerous as we have seen them on the leaves of the Clinton grape in this county, it would be nothing strange if they should also attack the roots in time. The investigation of these insects is attended with many difficulties, on account of their minute size, and their very peculiar erratic economies; and notwithstanding many observations have been made, and much has been written on the subject, their history is by no means clear to the ordinary perception of those who are most interested in its development.

A liberal reward, amounting to some millions of francs, has been offered by the French government for a certain remedy to destroy them, which has not yet been awarded, if it has even been claimed; and the Academy of Sciences has appointed a commission to institute the proper investigation; but we believe nothing that can be universally applied has yet been developed. Submerging the vineyards has been deemed the most effectual, but this, of course, cannot be applied except on low flats; therefore, so far as it relates to highland or hillside yards, it is entirely out of the question. Perforating the ground near the vines, and introducing an insecticide has been found beneficial in such localities, but even these remedies have not been of sufficient efficacy to claim the rewards that have been offered. In the face of these discouragements, the French grape culturists are looking to ward *prevention*, and consequently are beginning to import largely from America our hardier varieties of the grape, as root stocks for new vine-

yards, and are digging out and destroying their own finer varieties, as it is these which have been most subject to the attacks of the Phylloxera. The insect seems bound to run its course, and perhaps after that the afflicted districts may enjoy some repose, but more millions of dollars may be lost before that auspicious period arrives.

The history of the procreation, transformations, habits and specific development of the *Phylloxera vastatrix* is too complicated to be made clear to the mass of the people, or even to the generality of the horticultural public, mainly from the exceeding minuteness of the subjects, and the eccentric order of their transformations. From the weight of the evidence, as the question now stands, it appears to have had its origin in America, from whence it was somehow introduced into England, and from thence to France.

Dr. Fitch, of New York, described grape-leaf galls formed by this insect, under a different name, years before it became destructive in Europe, or perhaps even before it was known there, and we noticed the galls in Lancaster county, even before Dr. Fitch described them. During the existence of the Old Horticultural Society, about 1855, an infested vine was brought to the meeting for the month of July; but of course, it was an enigma that we could not then answer, and the matter passed off. Five different kinds of the eggs, and of different sizes, are deposited by the females, and if the *depositor* is so small as to elude human observation, except by artificial means, the difficulty of recognizing the *deposit* is a matter that is not very surprising under the circumstances.

These insects deposit their eggs on the under or downy sides of the leaves—occasionally a few of them are deposited on the upper sides—under the loose bark of the trunk or branches, at the base of the vines, or in crevices in the earth in proximity to them; and when the young are hatched they find their way to the roots and feed on the sap either of the roots or the leaves, as the case may be. Both winged and unwinged males and females occur, all having a somewhat different history and habit. The eggs of the leaf form of the insect are deposited in May and June, and both kinds continue to deposit eggs as late as the end of October, and under one peculiar phase of their development some of the females lay a single egg, nearly as large as the parent, and which afterwards increases in size. In view of this system of oviposition on the cause of the grape, it is recommended to strip off the bark and burn it, and to apply coal oil, dilute carbolic acid, or other similar substance to the canes. Although there seems to be some conflict of opinion among those who have been giving their attention to the investigation of the history and habits of this insect, it is now claimed that the subject is nearing its completion, if that end has not already been attained.

But satisfactory as the case may be to those who have time, patience, ability and opportunity to demonstrate to the few who may have the penetration to comprehend the process and results of their labors, there is still need of a plain historical detail of the insect and its various transmutations, embracing the leading facts of what is actually known, with all the repetitions, complications and doubtful points eliminated; so as to make the subject practically useful to that portion of the community who are engaged in viticulture, whether they are amateurs or professionals. Even *then* it will require closer habits of observation than many people may have time or inclination to bestow upon such a subject, in order to make an application of the remedies that experience may prescribe, however effectual they may be. Under any circumstances there are many who would rather discontinue the growing of grapes altogether, and devote their time and means to a less precarious crop, than to subject themselves to slow, troublesome and expensive remedies or preventions. We hope, however, it may be a long day before our county or our country is visited by such an infliction as has visited France. Missouri and California ought, however, to admonish us that we cannot depend on entire exemption.

ELM TREE LEAF BEETLE.

(*Galeruca xanthomelœna.*)

BY S. S. RATHVON.

On the 5th of August, 1876, our attention was called to a multitude of "singular worms" on the pavement under an English elm tree, near the south-west corner of North Duke and East Orange streets, and subsequently to the large elm in front of St. James' Episcopal Church, as well as to a row of elms in front of the residence of Mr. F. Shroder, in East Orange street; and a few days afterwards Mr. Jno. Hager sent us about a gill of the same worms, from his residence in the western suburbs of Lancaster city. On examination these worms proved to be the *larvæ* of the coleopterous insect above named. When we visited these places we found these larvæ crawling down the trunks of the trees in great numbers, and collecting in masses around their bases, as near as they could get to the moist earth, and many of them had already changed to the pupa state. A large number of them, however, crept into the crevices, and under the loose bark, and pupated there, whilst others crept close to the base of the buildings and pupated there; and possibly, if they could have done so, they might have crawled a little distance into the earth. We could have swept together at either of the places above named, enough to fill a pint measure, and still they were coming in multitudes.

The foliage of the trees above was perfectly riddled in millions of small holes, or entirely skeletonized, presenting a crisp and blighted appearance. In a preliminary article, published in the *Daily Express*, we stated that these insects were a foreign importation, and that they first made their appearance on the elm trees in the vicinity of Baltimore, as now appears more than thirty years ago, and were very destructive. This is their first appearance in Lancaster county "in force." Mrs. P. E. Gibbons found several specimens on an elm, near her residence, about two years ago, and Mr. Auxer informs us that he found several last year, in Pequea valley. From this it will be manifest that the insect is increasing in our county. Within one week after they had pupated, the mature beetles began to appear, and continued to do so from the above date to the end of the month. These insects belong to a large family of hibernating species, and therefore if they were not generally destroyed when they came down from the trees —as we recommended—we may have them in increased numbers next season. Both the *larvæ* and the *imago* of many of the Galerucans feed on the

foliage of trees, and when they are numerous they possess great defoliating powers.

THE REMEDY.—When these insects occur on the foliage of a tree that it is desired to save, a liquid poison (Paris green, hellebore, tobacco, carbolic acid or whale oil soap) should be thrown on it from the nozzle of a garden engine; but when the tree is large this would be almost impracticable. The larvæ, when mature, descend from the tree and no doubt undergo their transformation either in the ground, or among rubbish or grass at the foot of the tree; and from our experience the present season, this occurs during nearly the whole month of August. The fact that they assembled in the places they did in this city, may have been owing to the circumstance of their being unable to penetrate the ground—the trees being paved all around with brick—and some of them we found amassed in corners and crevices around a marble door step, and along the base of a wall, ten feet from the trees. Under such circumstances the larvæ and the pupa may be easily gathered up and scalded or burned. The mature insects no doubt ascend the trees again and feed on the leaves until their fall late in the season. We have found an allied species (*Diabrotica vittata*) feeding on wild plants in the woods, on warm days in November, and these might exhibit similar characteristics; and this character pervades nearly the whole great family to which they belong (Chrysomelidæ.)

DESCRIPTION.—These larvæ are $\frac{3}{8}$ of an inch in length; the head and feet black; color, glossy yellow, two swarthy lateral stripes, and a dorsal yellow stripe; the segments are divided transversely above by a distinct suture, exhibiting twice as many segmental divisions above as there are below; each segment, above and within the yellow stripe, has four dark tubercular dots, surmounted at the apex with a few short diverging hairs; on the lateral dark stripes are three similar dots, triangularly arranged, on each segment; indeed, the lateral stripes are formed by the color of the tubercles extending down a little beyond their basis, leaving narrow yellowish insterstices between; on the abdominal segments are marginal rows of yellowish tubercles armed with hairs, similar to the others, on a minute, dark, apical tip; on the under side—which is yellowish—there are four dark dots on each abdominal segment, and a dark central dash, latitudinally arranged.

The pupæ are $\frac{3}{16}$ of an inch in length, (when stretched out straight $\frac{1}{4}$ inch,) lemon yellow in color, and the antennæ, feet and wing covers folded over the *sternum*, as is usual in coleopterous pupæ; along each side of the abdomen a sort of frill, more or less, projects outward in sections, those of the greatest depth about the centre. These pupæ are entirely disengaged from any other object, naked and unprotected.

We omit a description of the *imago*, because the description of *xanthomœlena* given below covers them as nearly as anything we could give, and we quote the description of two different insects in deference to the opinion of those who supposed this insect to be *Galeruca calmariensis*.

"*Galeruca calmariensis*, Lin.—Oblong-ovate; above testaceous; deeply punctured; crown, furrow on the thorax, scutellum, a dash on the elytra, breast and base of the abdomen black; apex of the abdomen and base of the antennæ testaceous. (L. 2—2½ l.) Aquatic plants; London district; Weston; Bristol; Swansea."

"*Galeruca xanthomœlena*, Schon.—Oblong-ovate, flattish; above griseous yellow, thickly punctured; crown with a triangular black spot, and another geminated one at the base of the antennæ; thorax with three black spots; elytra with a long black dash within the margin, and a short streak near the middle; legs dull yellow, thighs with a dusky spot without, tibia with a black streak, hinder pair bent. (L. 3 l.) Elms; London district."—From Stephens' Manual British Coleoptera, containing brief descriptions of all the species of beetles hitherto ascertained to inhabit Great Britain and Ireland. London, 1839.

"*Galeruca Calmariensis*, Lin.—'Elm Galeruca.' An oblong oval beetle 0.25 long, of a grayish yellow color, with three small black spots on the thorax, a broad black stripe on the outer part of its wing covers, and a small oblong spot near their base; though originally named by Linnæus from a small seaport town of Sweden, is common over the chief part of Europe, feeding upon the leaves of the elm, to which it is sometimes very destructive. It has been introduced from thence into this country, and on its first appearance in the city of Baltimore some twenty years ago, it and its larvæ, which are thick cylindrical blackish six-footed grubs, wholly denuded the elms of their leaves, for several successive seasons."—From Fitch's 5th Report, 1859. Ins. N. Y.

What Dr. Harris says about this insect in his otherwise excellent work, is not of the least assistance in determining its species. He merely states the fact of an insect called *Galeruca calmariensis*, which in its larva and mature states depredates upon the leaves of the elm trees, but aside from this there is no positive evidence that he had ever seen a specimen of it.

We should probably have ticketed this insect *G. calmariensis*, without any hesitation, from Dr. Fitch's description alone, had we not had Stephens' prior description also before us; in which he conspicuously omits the marginal dash or stripe, and states that that species feeds on aquatic plants instead of the elm. But it is not necessary here to repeat all the distinctions between *calmariensis* and *xanthomœlena*, for the foregoing descriptions, from Stephens' work, will plainly show those distinctions; and, although neither of them may entirely cover the insect we have under con-

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sideration, the weight of their testimony, to our apprehension, is in favor of the latter named species, and any one who chooses to do so can make the comparison for himself; but from these descriptions, we could easier conclude that the present subject is a species differing from both of them, rather than that it is the former. Therefore, until the question is decided by more competent authority, we feel disposed to ticket our insect *xanthomælena* Schon.

Since writing the foregoing we add the following from Dr. John L. Leconte, to whom we had submitted specimens for his examination :

"DEAR SIR :—The *Galeruca* you have, so injurious to your elms, is *G. xanthomelœna*. Gyllenhal, in error, described it as *calmariensis* Fab., quite a different species.

Very sincerely yours,

J L. LECONTE.

PHILADELPHIA, *September* 5, 1876."

There is a slight orthographical difference between Dr. Leconte's rendering of the specific name and that in Stephens, but this is unimportant in the history of the insect.

CLIMATOLOGY.

This is a subject that has arrested the attention of scientific men of late years in all parts of the country, and it certainly demands the fullest investigation by men engaged in agricultural pursuits. It is of very great importance to an agricultural people to occupy a country, the climate of which is well adapted for the raising of certain crops. The knowledge therefore of the mean temperature and the quantity of rain which falls in different parts of an extensive country is of great practical importance to its inhabitants, not only in regard to agriculture, but also with reference to navigation, devastating floods, driving of machinery, supply of water to cities, etc.

Few districts, says Professor Rogers, of the United States, or indeed of the world, are more favorably circumstanced as to rain than Pennsylvania. Lying within the belt of non-periodic rains, it is blessed with a *singularly equable distribution of moisture throughout the year*, the State is seldom visited by a drought, and if any do occur, take place in the latter half of the summer. These dry periods do not appear more frequent than once in four or five years, and rarely so severe as those which visit the West and other parts of the country. It is in like manner comparatively exempt from protracted and flooding rains. The rains take the form of light rain storms of one or two days' duration and of intermitting showers, and these excepting during the occasional summer and autumn droughts are spread with remarkable impartiality *over the several seasons*, and over all the several months of the year.

At Philadelphia, the annual average of rain fall is about 42 inches; at Carlisle 34 inches, and at Pittsburg 35 inches. It would seem to imply that the mountain rains of Pennsylvania are derived, to a considerable amount, from the far removed Gulf of Mexico, the south-west wind from which has parted with a large share of its moisture on its journey, while the Atlantic slope, or seaboard receives an additional supply from the more *local winds of the ocean*. At Philadelphia during a period of 18 years, the fall of rain and snow was one year 35 inches, and in another 55, and at Pittsburg during the same years it was one year 25 inches, while in another year it was 47. It is seen in the Central States of the Union, that in some years less than half the average quantity of water falls, and in others nearly double the average quantity.

The annual average rain fall upon every square mile of the Mississippi valley is about 40 inches; and in England about 35 inches, including 5

inches of dew, and for the whole globe about 34 inches. The mean annual quantity of rain is greatest at the equator, and decreases gradually as we approach the poles. Thus, at Calcutta the annual quantity of rain fall is 81 inches, and at St. Petersburg, in Russia, it is only 16. More rain falls in mountainous countries than in plains. Among the Andes it is said to rain almost perpetually, while in Egypt it hardly ever rains at all.

The highest part in North America lies between the 40th and 50th degree of north latitude. The great rivers originate there. It is covered with immense forests and abounds with large swamps and morasses, which render it incapable of receiving any great degree of heat, hence the rigor of winter is severe.

There is in the northern hemisphere more land, less sea, more fresh water, and more atmospheric air than there is in the southern. About two-thirds of all the fresh water on the surface of the earth is contained in the great American lakes. The Pacific feeds the clouds with vapor, and the rains feed the Atlantic with rivers. The Gulf Stream in the Atlantic, and the Mozambique current in the Pacific, are rivers in the ocean. The influence of the Gulf Stream upon the climate is very great. Tables of the quantity of rain-fall at various places in the States of the American Union indicate no signs that the seasons on an average for a series of years have changed; nor that the winters are colder and the summers hotter and drier than formerly. In 1813, at Norway, in the State of Maine, 9½ feet of snow fell; in 1831, 9 feet, and in 1845, 9½ feet. Providence, Rhode Island, had 30 inches of rain-fall in 1835, and in 1848, 40½ inches. In 1858, Florida produced 79 inches of rain, Maine 42, Mount Joy, Pa., 44, Philadelphia 39, Sacramento, Cal., 17, and Westfield, Mass., 43 inches. From a table of the Smithsonian Institution for twelve months, ending in June, 1868, it appears no rain fell in California in July, August, September, November, December, February and March. Twenty-one inches fell in the month of May, and the balance of the months 8¼ inches; total, 29¼ inches, at three places of observation. Pennsylvania, during the same time, at 25 places of observation, produced nearly 44 inches; Ohio, at 19 places, 40¼, and Florida, at three places, 56 inches. At Ephrata, Lancaster county, Pa., during the year 1870, the amount of rain-fall was nearly 42 inches, distributed with considerable uniformity through the several months of the year.

Very many writers entertain the opinion that our winters are colder and our summers hotter and drier than formerly, and the streams smaller than fifty years ago and that the clearing off of our forests diminshes the volume of water in our streams.

The winter of 1780 was the coldest winter known in Philadelphia until 1855, 1856 and 1857. The winter of 1835 was very cold, and the earth cov-

ered with an abundance of snow, and the winter of 1875, with but little snow or rain.

The winter of 1828 was very wet and mild, and the winter of 1842, farmers plowing with their coats off every month in the winter; no ice and very little snow. The winter of 1851 was also very mild, and the winter of 1876, which we all remember very well, was snowless and iceless in these parts, and to a considerable extent over our country. The last six months of 1874 and the first six of 1875 were very dry; wells and streams failed; waters lower in our mill streams than for forty years, in this section of country, and the winter intensely cold. The winters of 1783 and 1784 were nearly as intensely cold as that of 1780, and by referring to the severely cold or mild winters, that it rarely happens in a period of a century that we have a long succession of very cold winters or mild ones; that they change about to give us a taste of each; and on an average our winters are not any colder than they were a hundred years ago, or the summers any hotter.

And the same equitable law seems to prevail in its effects upon the state of the quantity of rainfall, snow, dew, fog, mist, wind and storms. The prevailing opinion that our forests are too unsparingly swept off by the woodman's ax, is well enough; but that our principal streams have lost in the volume of water in a century is not so clear or so well sustained.

Having been born on the west bank of the Conestoga, and having spent my boyhood along this beautiful winding stream, and recollecting all about it for a half a century, I hope I will be pardoned for giving my impressions of the vagaries of this valuable stream, which furnishes an abundance of pure water for the clever inhabitants of the city of Lancaster. In the winter of 1822 there was a great flood, doing much damage. In 1850 there were two tremendous floods in the latter half of the summer, sweeping away bridges, crops and fences. In 1869, in the fall, there was another great flood, exceeding in destructiveness any flood remembered by the oldest inhabitant or tradition, sweeping away corn, bridges, saw-mills, etc. Since then the stream has not at any time been unusually swollen. In the fall and winter of 1874-5 the Conestoga was lower for a longer continued time than for forty years, owing to the dry weather in the fall and winter. During a period of forty years it does not appear that this stream has decreased in volume on an average, taking a series of years together. According to tradition and the recollection of its oldest inhabitants, it was more frequently lower half a century since than of late years, although the country along it and its tributaries, was then much more wooded than at present. Forty years ago there was an almost unbroken forest along the Conestoga from Lancaster to and beyond Hinkletown; now it is nearly all cut off,

and the land in ahigh state of cultivation, and yet the stream is as strong as ever.

In 1868, England was visited in the summer of this year with a dry, hot season, such as had not been known in the south of England for seventy years. There was not the slightest trace of dew at night; and the excessive dryness was owing to the prevailing polar currents; water for sheep had to be carted for use from morning to night, while at New York large quantities of rain had fallen during this time. In Scotland the water was scarce on many farms, where such a want is seldom felt. The channels of streams were dry and farmers were wistfully looking for rain. Such is the case very frequently while it is very warm and dry at one place, it is warm and rainy at another place or country.

We are very apt to imagine that when a winter is bitter cold, or a summer unusually hot, that our climate has changed; but this is a delusion. The same is true of hot or dry seasons. In Camden, South Carolina, in the year 1838, there were four months, May, July, August, September, in which not a drop of rain fell, and the number of rainy days was very few, and the quantity of rain during the year extremely small. The fields and gardens in this place and immediate vicinity were almost literally scorched. Tomatoes, beans, corn, pepper, and all vegetables were destroyed as if a fire had gradually burned them. From the 19th of March until the 17th of April the sun and moon, both at rising and setting, were of a blood-red color.

In Summerville, Georgia, near Augusta, in the year 1839, the summer and autumn were extremely dry. The Savannah river had not been so low for seventy years, and never known to continue low so long at one time before within the recollections and traditions of the oldest inhabitants. Acres of its bed were run out, fenced in, ploughed and planted in the autumn. From the 20th of October to the 3d of November, the sun rose and set, and the moon rose, appearing like blood-red balls of fire.

At Marietta, Ohio, in the year 1838, the heat and drought of the summer continued till the 22d of September, when there fell a little more than an inch of rain. All the crops which depend upon the summer months for their growth, as potatoes, Indian corn and beans, suffered exceedingly. Pastures were dried up in August, so that some farmers began to feed their cattle and horses early in September with hay. Many were subjected to great inconvenience for the want of water. Mill streams failed, so that many farmers were obliged to take their grain fifty miles or more to mills worked by steam power.

In the year 1839, at Marietta, Ohio, the quantity of rain and melted snow during the year was a little more than 33 inches, being about 9 inches less than the mean quantity for this region. Yet the distribution

of rain was so equal that every month had its due share in such seasonable showers as to afford a good supply for vegetation, and crops of all kinds, of grain and grass were never more abundant.

Wm. C. Bryant says the streams in eastern Ohio are smaller, and the weather drier than fifty years ago; but had he been there in the summer of 1875, and seen the wet weather in Ohio and Indiana during harvest time, and the grown and spoiled wheat, he would, perhaps, have changed his opinion.

In 1831 Lancaster county was visited with continued wet weather for fourteen days, right in the midst of the grain harvest, and in consequence the wheat nearly all germinated, thus destroying its glutinous quality, making it worthless for bread. In 1838 very dry weather from July to December. During this long period very little if any rain fell; mud roads were six inches deep with dust; corn and potatoes failed entirely; pastures were scorched, the air filled with dust and grasshoppers. The grass fields looked like plowed fields; farmers were obliged to feed their horses and cows on hay early in the fall. There has not been such a drought in Lancaster county since, although in the last six months of 1874 no great quantity of rain fell. The frequent light showers kept vegetation in a vigorous condition, so that the fall crops and pastures were abundant.

Much more vapor rises during hot weather than during cold; hence the quantity evaporated depends in some measure upon temperature. Much more vapor arises in maritime countries, or those interspersed with lakes, than in inland countries.

From a table of Dr. Dalton, of Liverpool, England, for four years, ending in 1775, it appears that the mean annual evaporation from the surface of water amounted to nearly 37 inches.

It is estimated that five inches of dew is deposited upon the earth in England in a year. No day passes without rain in some part of the earth, so that part of the evaporated water is constantly precipitated again. The annual evaporation over the whole surface of the globe is about 35 inches annually.

Stones and sand have a less capacity for heat than the earth has, which is always somewhat moist; they heat or cool therefore more rapidly and to a greater degree. Hence the violent heat of Arabia and Africa, and the intense cold of Terra del Fuego. Living vegetables alter their temperature very slowly, but their evaporation is great, and if they are tall and close as in forests they exclude the sun's rays from earth, and shelter the winter snow from the wind and the sun. Woody countries, therefore, are much colder than those which are cultivated.

Evaporation takes place in plants to an inconceivable degree under certain circumstances. It is known by the experiments of Dr. Hale that a sunflower plant will lose as much as one pound and fourteen ounces by

evaporation in twelve hours. In damp or wet weather this evaporation is least; in hot, dry weather it is greatest.

The annual amount of evaporation from a given surface of water in the interior of the country is greater than that of the rain which falls on the same surface, but the amount of evaporation from the surface of the ground is generally less, particularly in mountainous districts. Less vapor is given off from the surface of salt water than from the surface of fresh water. Perhaps as much as five times more vapor arises from fresh water as from moist earth. Water is constantly evaporated from the surface of the ocean; the amount, however, diminishes as we proceed from the equator towards the poles. The valley of the Mississippi owes its fertility principally to the moisture which proceeds from the Gulf of Mexico and the intertropical part of the Atlantic Ocean.

The influence of the nature of the soil on the climate of a country may be inferred from its greater or less power to absorb and radiate heat, and from its capacity to absorb, or transmit over its surface the water which may fall upon it in rain or be deposited in dew.

The influence of cultivation on the climate of a country, drying up of extensive marshes and systems of drainage which would evaporate, and by the latent heat thus absorbed would cool the ground, is suffered to pass through it to the drain beneath, and is thus carried off without depriving the earth of a large amount of heat, which would otherwise be lost.

The Andes Mountains in the trade wind region stand up so high that the wind, in order to cross them, has to part with all its moisture, and consequently there is on the west side, as in Peru, a rainless region. Upon the Red Sea there never falls a drop of rain; it is all evaporation.

The Parana, the Ganges, and the Nile annually overflow their banks. The rainy season, which is periodical in these climates, floods the rivers. From these inundations the inhabitants derive happiness and plenty. The Nile begins to rise for forty days, and decreases for about as many more.

There are rivers which are said to lose themselves in chasms under the earth, and flow for miles in secret and undiscovered channels. What seems to occasion the loss of the Rille, the Ithon, and the Aure, in Norway, is the nature of the soil through which they pass. It is in general porous and composed of thick sand. There was a river in Greece which suddenly disappeared in the sand, and seemed wholly lost; but far away in Sicily it rose again, undiminished, and flowed on as before. The Wolga, in Europe, is said to abound with water during the months of May and June, but all the rest of the year is so shallow as scarcely to cover its bottom.

Some rivers, like the Po, in Europe, and the Mississippi, in our country, ran on higher ground than the country through which they flow; but the banks made to keep them in sometimes break, when the devastation is great.

ABOUT POTATOES.

BY S. S. RATHVON.

"What's the matter with the potatoes?" This is a question now generally asked by the potato consumers, and especially by their prudent housewives. The almost universal complaint is, that the potatoes now brought to our markets are not nearly so plenty, so large, or of so excellent a quality as those obtained early in the season, and they want to know "what's the matter," especially since there has been so much "blowing" about our Centennial crops.

We will essay an answer to the very rational query, as it occurs to our apprehension, supported by the testimony of those who ought to know whereof they are speaking. In the first and most essential place, there has not been as many potatoes planted this season in Lancaster county as usual, on account of the "beetle," but more particularly on account of the better prospects in tobacco. Last year the potatoes were low in price and plenty, whilst tobacco brought a good price, and the market was firm. Then the cultivators reasoned thus, "We will 'put in' tobacco and buy our potatoes." And through this reasoning we will have more tobacco and fewer potatoes.

A redundant crop of tobacco, however, will never compensate a depleted crop of potatoes, unless some mode is discovered by which the former can be cooked and eaten like "greens," and the surplus can be salted down like "kraut." But enough on that score.

Secondly, the reason the potatoes are not so good now as those that matured early in the season, is because they were planted too late, and not late enough. The early crop made during the cool moist early summer weather, and matured about the time the intense heat set in, whilst the later crop made during the intensely "heated term," and their natural ailment was too rapidly evaporated through a protracted dry "spell," and matured when it was too late to regain what they had lost. Those that were planted very late, and are now making, and that will mature during the latter part of September and the fore part of October—other things being equal—will be of a better quality. The common potato is not adapted to long-continued and intensely hot and dry weather. Those conditions are congenial to the sweet potato, but not the solania, and hence the former, at this time, are of a good quality generally.

We have only to compare the potato crops of New York State and Canada with those of the Carolinas and Georgia, in order to determine the meteorological conditions they require. Still, occupying a middle geographical locality between those two extremes, we may and do raise good potatoes here, when all the natural conditions are favorable; but as a general thing, we should plant very early and very late, in order to realize a reasonable prospect of a good crop, and particularly a good quality. Potatoes are very succulent, and while the tubers are forming they should not have too much heat nor too much drought. They need considerable moisture, but not too much. The ground being kept loose by cultivation, is in just that condition to permit a too rapid evaporation of the earth's moisture, when a long, hot, dry spell intervenes. True, the "Colorado potato beetle," until it is finally exterminated in our county, will be something of a drawback to the cultivation of potatoes, but that does not account for the inferior potatoes brought to our market now. We think it is owing almost exclusively to meteorological causes.

WHEAT GROWING.

BY J. B. GARBER.

Some weeks since I saw a statement in a paper, published at Mechanicsburg, also, nearly the same statement in the Monthly Agricultural Report for May and June, the purport of which was, that Mr. J. M. Heiges, of York county, had grown seventy-one bushels of wheat on an acre of ground. these reports were so extraordinary that I was rather skeptical as to their truthfulness. To satisfy my doubts I addressed a letter of inquiry to Mr. Heiges. He very kindly answered my letter at length, saying the reports, as stated, were perfectly true; that he actually raised at the rate of seventy-one bushels per acre. Also, that he grew fifty-five bushels per acre of the Foltz wheat in 1874; and, in 1875, another variety produced him 49⅝ bushels per acre; and this season his choice variety produced him only 51 bushels and 21 lbs. per acre. He gave a neighbor 2¼ bushels last fall, and this neighbor now reports 102 bushels grown on 2¼ acres! This neighbor is a member of the York County Agricultural Society, is 65 years of age, and says it is the best yield he ever had. Now, when one or two farmers can grow 50 to 71 bushels of wheat to the acre, *why can not other farmers do likewise?* At this rate wheat-growing will pay as well, if not better, than growing tobacco. My impression is that Mr. Heiges' soil is not naturally very strong or rich.

But to give Mr. Heiges' mode of culture, and which I apprehend is the main cause of his success. He sows his wheat on oats and wheat stubbles, but *manures heavy* and *plows deep*, and plows the second time *still deeper*, pulverizes his soil thoroughly, and sows his wheat about the 25th of September, and has not had a failure since he commenced his present mode of culture. One of his reasons for adopting this plan was that he thought we were not raising half enough wheat per acre, and as he would not plant ten grains of corn in a hill, or plant a field of corn and not cultivate it, he asked himself why it would not pay to cultivate his wheat as well? He tried a sixth of an acre, and his yield was a little over eight bushels. He tried an acre next year, and fifty-five bushels was the result. He has taken four crops of wheat from one plot of ground in succession, and intends sowing the same field again this fall. Had as good wheat on this plot as he saw on any other ground.

As before stated, his plan is to manure heavy and plow deep, pulverize his soil thoroughly, and about the 25th of September, plows again a little

deeper still, and prepares his fields into ridges and depressions—the depressions about 12 inches wide and the ridges about 10 inches, sowing the wheat broadcast, and going over with the harrow in the way of ridges and depressions; then dragging, so as to make the field perfectly level; thus the seed nearly all fall into the 12-inch depression, or spaces of a regular depth. Then, in spring, so soon as the ground becomes moderately dry to work, he goes through with some kind of a cultivator two or three times, until the wheat becomes too high, thus giving regular cultivation, the same as a field of corn. This spring cultivation, no doubt, is the cause of his great success.

He has two varieties of wheat—"Champion Amber" and "Heiges' Prolific"—that are very stiff in the straw, stand up well, and are both bald wheats. Though Mr. Heiges considers both these varieties as very superior, yet he does not believe that by the ordinary culture, they would produce such great crops as by his mode of culture.

MANURIAL VALUE OF CLOVER.

If clover has been sufficient to sustain Mr. Geddes' land, may we not reasonably conclude that it will do as much upon these rich prairies? If I understand him correctly, only one crop of clover is ploughed under in his five years' rotation. Is this so? Can he or some one else tell us what is the value of cornstalks for manure? Here in the corn growing region much land is cropped with corn continually without manuring, the stalks being broken down, then raked and burned every spring, and many men contend that better crops can be grown when the stalks have been burned than when they have been plowed under. Others, like myself, contend that the stalks should always be plowed under, first running a stalk cutter over the fields, which cuts them into lengths of about one foot. I think that returning the annual crop of stalks will do much toward preserving the fertility of our soils, even if the corn is removed. Who can tell us what is the manurial value of an acre of heavy stalks, standing say eight feet high? Does chemistry give us any light? What says experience? Will Mr. Geddes give us his opinion?—*H., McLean co., Ill.*

ANSWERS BY GEORGE GEDDES.

I am asked whether it is our rule to plow in a crop of clover once in our five years' rotation. Yes. But this rule cannot always be carried out, for it sometimes happens, as it did this year in many places, the clover crop is destroyed by freezing and thawing in the spring, and thus we have no crop to plow under. And again, the seed sometimes fails to "catch," and this makes it necessary to put in another crop, and try and make clover grow with that. The failure of a crop of clover seed in "catching" is a serious matter. A few weeks since, walking with the venerable and well known John Johnston through a field of his wheat, and observing as to the promise of a crop, I was asked to see if any of the clover was starting after the long drouth that had just been terminated by a heavy rain. Eighty-three years had dimmed his vision, but not his zeal as a farmer, and he called for a little help, and when told the clover was coming he said: "Ah! that is more important even than the wheat; for if we lose our clover we must go right over the work again, and put in another crop with which to seed with clover." I cannot add anything to this dictum of the highest authority in the land.

Five-year rotation—first year, clover and timothy meadow; second year, pasture; third year, corn; fourth year, barley or oats, followed by wheat sown in the fall to be harvested the fifth year—the clover and timothy seed

being sown with and on the wheat. This is the theoretical round, but circumstances very often break into it. In fact is hardly ever strictly carried out through all the fields. One-fifth of the farm in corn is too much at present prices of manual labor and corn. So it quite often happens that a piece of clover land that has been used one year for meadow and another for pasture is sown to barley or oats, and that crop followed by the wheat. Thus the course is, in part, reduced to four years, two of them being given to the clover and timothy, and this is all the better for the land, as we have the land half the time in restoring crops, and the other half in exhausting crops. How disastrous to all this a failure of the clover is, can be readily understood; not only is the rotation broken into, but the manuring is prevented.

The best protection against loss of clover by its freezing out in the spring is thorough drainage of the land. It is the water in the land that expands by frost. If there is no excess of water in the land, the freezing does very little harm, except in the very special and rare case of thawing several inches of the surface, leaving the subsoil still hard frozen. If a cold night comes and freezes two or three inches of the top of the land while the long tap root of the clover is held fast below, the expansion of the surface will lift up the crown of the plant, and in so doing break off the tap root. As the ground becomes warm and again free from frost, the broken clover roots may be seen standing above the ground, where the frost left them—dead. Two-year-old plants suffer in this way much more than the shorter rooted plants that have only had the previous season in which to grow. Their tap roots are shorter, and they have most of their lateral roots very near the surface of the ground. The injury to clover, in its second winter, was very great in central New York this season, and especially so on undrained land. A liberal covering left on the soil helps to protect it against the frosts that kill clover, and having made his land free from stagnant water and allowed it a liberal covering in the fall of its own production, the farmer must abide the result, with the feeling that, having done his duty, he has nothing to do in the future but to be governed by whatever may come to pass.

I am particularly asked, when to plow under clover? The clover is doubtless of most value to plow under when it has fully matured its growth, both of top and root, and this will not come till the second crop of the second year has gone to seed. By the second year I mean the year after the seed was sown. Supposing one crop, the latter part of June or early in July, had been cut for hay, a second crop of the medium clover will mature and bear seed before cold weather. This crop is too valuable to be plowed under, for the seed will usually be worth not far from $15 per acre. So it is not usually good economy to plow clover in for manure when it is worth most for that purpose, for then it is worth still more for seed.

Our clover fields are usually cut for seed the year after the wheat has been harvested, having earlier in the season given us a crop of hay. In cutting the seed crop a harvesting machine is used, and the stubble is left high. If the plow fallows that fall, there will usually be left on the ground as much clover stubble as can well be plowed under. The matured roots all being there the land is given a heavy dressing of manure. If the plowing is left until the next spring, the same manure is there, though flattened down by the snow; and if not plowed into until May for corn, there will be added a considerable spring growth to go under with it. The spring growth often furnishes ewes with young lambs the food they most love, and generally is better disposed of in that way than for manure. Supposing the second year after the wheat is harvested the field is used for pasture, a liberal allowance of clover and the grasses that grow with it is plowed under in the fall, or left over for the next spring's plowing.

Of late years we have rarely plowed under full crops of clover for manure when we had any other use for it, such as making hay or feeding off by stock. The roots, the leaves and stalks that accumulate on and in the ground, under our system, have been sufficient to keep up fertility with the help of manure made in the yards and stables. Lands that have been "scourged" by cropping, without compensation, require a different treatment; and to renovate lands that are what is called "worn out," the largest quantity of top will be required as well as the roots.

To again refer to Mr. John Johnston's methods of culture in raising wheat, to show how lands may be made very productive, I will state that during the most of the years of his owning and managing a large farm, wheat was considered the paying crop, and other crops were mostly raised with a view of promoting the greatest yield of wheat when its time to occupy the ground came. Supposing him to have in the spring a field of good clover; when it was as large as he could plow it into the ground, he would commence his summer fallowing; and having mixed his crop of clover thoroughly with his soil, and killed the weeds, he would sow his wheat and reap a large crop. Clover seed was duly sown on the wheat in the spring, and great quantities of barn-yard manure were spread during the fallowing on the poorer places in the field.

If this land was not required for any other crop, he would again summer fallow the year after the wheat was cut, and thus take a crop of wheat every two years from the same land, and by the free use of clover, (gypsum being sown on it) and yard manure, he found no difficulty in raising constantly increasing crops of wheat. To provide his yard manure he usually purchased sheep in the fall and fed them during the winter on hay, straw, corn and oil-cake meal, and sold them to the butcher in the spring. Sometimes he fed as many as a thousand at once, calculating that if he received

the market value for his corn and hay, and pay back for the oil-cake he bought, that he did very well, and had full compensation in the manure, though he never failed but once in making a handsome direct profit on his sheep. Perhaps no man has in this country been more successful as a raiser of wheat than Mr. Johnston, or has, on a large scale and for a long series of years, averaged larger yields.

In talking over his methods of farming, he will dwell constantly on the importance of barn-yard manure ; but careful attention to his story will show that few men have used clover more than he did. Some years since he sold most of his land and reduced his farm to about one hundred acres, a considerable part of which he rents at an annual sum of $25 an acre to nurserymen to raise fruit trees on, and he no longer raises crops on large areas. Should he now resume business on the scale of forty years ago, he would find that other crops besides wheat brought money and had a quick sale, and he would act accordingly, but he would use no less clover or barn-yard manure. He would make his clover fill his yards, and he could no longer purchase oil-cake meal at the prices of olden times, and it is very doubtful if he would fatten as many animals as he formerly did.

IGNORANCE IN FARMING.

CORRESPONDENCE COUNTRY GENTLEMEN.

One of the greatest drawbacks to successful farming is the presence of the unknown quantity—ignorance of the exact condition of things, in value, weight and measure, concerning our products. We often produce at a loss. An account with each crop would decide the matter. If, after a few trials, it costs more to produce than a crop will sell for, its cultivation should be abandoned. Many continue to produce from year to year at a loss, simply from the want of a little calculation. The unknown quantity in weight and measure subjects us to great loss in buying and selling. A stack of hay came to my notice recently. The seller estimated that it would weigh a ton and a half. The buyer preferred to buy by weight. It weighed 1,850 pounds—quite a difference in favor of the buyer. There is no doubt that a great deal of hay changes hands every year on a basis no nearer the truth than this. Loss enough is soon made in this way to put in and maintain a hay-scale, even in a small neighborhood. The same thing is true in regard to live stock. Dealers can judge much more accurately than farmers, and are much less liable to be cheated. Farmers are much more liable to fail in buying than in selling. If we pay too much in buying, it makes an up-hill business all the way through. This is one great cause why many fail to make anything in feeding and handling stock. From considerable experience in weighing stock for others, I have found that the greater part fall short in weight from the estimate of the owners; some come very far short. Not more than five per cent. exceeds the estimates. Horses estimated at 1,100 pounds generally weigh about 1,000. Loads of hay called a ton quite often weigh only 1,200 or 1,500 pounds. Those who estimate the number of tons by the number of loads are often very much deceived, and in selling think they have been cheated, because the scales failed to show as much as they expected. Weighing will remedy this. The pound avoirdupois is a known quantity; after ascertaining the exact number, we are in a condition to go forward without making mistakes in our calculations.

Another unknown quantity is in failure to know the number of acres under cultivation. A farm which had been taken up when the country was new, and occupied by five successive generations of the same family, had a twenty-acre lot. On the death of the first member of the family, the farm was sold. The twenty-acre lot contained but fourteen acres by

ROYAL TOM.

actual measurement." Here were five generations of heroic workers deceived in the amount of work actually done, all the while supposing that they were cultivating six acres more than they really were. If the yield came up to what the increased acreage should produce, it did not matter so much. But the probability is that they were as far from the truth in the yield as in the acreage. I once bought a tract of salt marsh said to contain six acres. The surveyor made less than four acres, much to the disgust of the seller and the detriment of the reputation of persons who had gained a local notoriety for big days' work done thereon. Traditional "big days' work" often owe their existence more to some errors in calculation than to the amount of work really done. There is uncertainty enough attending the business of farming, from unfavorable seasons, and causes over which we have no control, without being subjected to loss in those we can remedy. We suffer loss from buying and paying for what we do not get; by selling what we do not get pay for, and in many other ways in which the unknown quantity affects us unfavorably. We should endeavor, where it is in our power, to eliminate it from our business.

ADVANCE OF THE PEAR BLIGHT.

We made a note of the fact recently that the virulent form of fire-blight, long the dread of pear cultivators in other regions, had at length made its appearance here. We now see by our exchange papers that it has manifested its dire presence in many places from New England south to Virginia, in sections where it had never before known, or known but slightly before. The cause of this sudden incursion is not very clear. It is, however, a matter of interest to note the singular opinions which prevail in regard to its appearance; and how remarkable it is that any intelligent person should hold such opinions in view of the facts before them.

First one says it is "lightning." Now we have had lightning since the world began, and certainly since the first pear, perhaps two hundred years ago at least, was set out in Germantown. It is rather late in the day for lightning to commence to play such pranks. And then there is this curious fact: if we cut out every particle of diseased wood that we can see, we may cut out more next week; and so on through the whole season after the blight has once begun. It is absurd to look to lightning to produce a continuous effect like this.

Then there are those who fancy the trouble comes from the effect of the "frost" either on unripe wood, or in some other way. But as in the lightning case, why should the frost remain quiet till the year of our Lord 1876 before rising to this mighty work? But irrespective of this, any one who looks can see that it is not unripe wood, unsound wood, weak wood, or any wood deficient in vitality, but often the soundest and best that is attacked.

And then there are others who are sure that it is some lack of important elements in the soil, or some disease at the roots that has extended to the tree, and produced the fatal results. But my practical fruit-grower knows that anything that affects the roots affect the whole tree. Even a borer in the collar of an apple tree makes that tree have yellow leaves in every part of it. There is not any part but is more or less influenced by what may happen to the roots. But a tree affected with fire-blight is often in perfect health. Every one who is familiar with fruit trees knows at a glance what perfect health is, and he can say positively that in a vast number of cases a blight struck pear is in perfect health. And then the upper part of a pear tree will be destroyed, though all below is good and sound.

Now we may not be able to say what the cause of pear blight is; but from what we have said it is clear that it is not any general cause that would affect the whole tree. It must be local; that is, a cause which operates on the parts destroyed and nowhere else. We may not yet see to the bottom of the trouble, but surely it is a gain to see this far.

FIRE BLIGHT.

This dire malady, the great foe to pear culture, has singularly enough let Germantown out of its travels to a great extent in the past. There may have been isolated and insignificant cases, but the pear as a general thing has been among the healthiest of trees. In surrounding districts there have been cases of serious trouble. To the north-east of Philadelphia, as well as on the west, there have been serious visits of the enemy; but even there it has been in a measure desultory, and season after season of perfect health have followed seasons of serious attacks.

This season, however, the fire blight has made its appearance to a serious extent in the old borough, and the "old stagers" who still travel by the coach and know nothing of the railroad, are asking what it all means. They have had in the past one hundred and fifty years of extensive Germantown pear culture, cold seasons and warm seasons, high temperature and low temperature, long hot and cold "spells," and rapid and wide changes, dry seasons and wet seasons, high culture, low culture, and no culture, dwarf tree and standard trees, while in varieties they have had Vicars and Seckels, and all the kinds known in the books, but no fire blight ever came here before. They are, therefore, quite sure that the predisposing cause is one that never existed before, and can be none of those suggested in the list above and which are so often referred to. What the cause is must be left to the philosophers, and no doubt they will make it clear in time.

One thing seems clear—and that is one that concerns us most—that is a preventive. Our old correspondent, Mr. William Saunders, of Washington, was once seriously troubled with the disease in the Experimental Garden; and he took to washing the stems of the trees with lime and sulphur in the winter season, and since then he has not been troubled.

Now, there is a possibility that this is but a coincidence, for we have seen that in the outlying districts of Philadelphia the disease has disappeared for some years after being serious, and yet nothing has been done. But in Mr. Saunders' case we hardly think it is of this character, for all of us who know of the devotion of the famous old fruit growers to their pursuits know how they used to wash trees with lime and other articles, and how healthy trees always were under this treatment. There is no doubt but judiciously washing the bark is conducive to health, and this fact favors the practice of Mr. Saunders.

But this can only be done when the trees are not in leaf; at this season all that can be done is to cut away and burn all the deceased branches as fast as they seemed injured, for whatever may be the cause of the disease it seems quite likely that diseased matter will communicate the trouble to healthy trees.

We have taken both of the foregoing articles on "blight" from the editorial columns of the *Germantown Telegraph*, and we find that the veteran editor of that ancient and ably conducted sheet is about as much in the dark on the subject of light as wet, and the rest of the world are. We opine, however, that the phenomenon of fire-blight is not as recent a thing as seems to be implied in the above extracts, for we are quite certain we have seen it, or something analogous to it, as much as five and forty years ago, and at many different periods since that time. We allude to the subject now because at the July meeting of the Lancaster Linnæan Society, one of the members exhibited a blighted pear branch, and felt quite certain that it was caused by an insect, the *Tomicus pyri;* but a critical examination demonstrated that it could not have been caused by said insect, or any other. True, there is a species of blight produced by the borings of the insect above named, but it does not take place so suddenly as the fire-blight, and, moreover, it is confined to that part of the twig or branchlet that is above the point of perforation, and it follows down the branch as far as the insect penetrates.

There are various species of these little blight beetles, all of which bore into different sorts of trees both living and dead. Some years ago a piece of a peach branch, three inches long and about half an inch in diameter, was sent to us from Maryland, which was seriously infested by blight beetles, which the sender alleged were killing his trees. We inclosed the piece in a close box, and in due time bred out a dozen or more of a small black species of *Bostrichus or Tomicus*, which we specially referred to *persica.*

But these insects are by no means the cause of what is popularly known under the name of "fire-blight," or "pear-blight." Rind, in his "Vegetable Kingdom," says: "*Blight* is one of the most common diseases which affect vegetables, and yet on the nature of which the greatest difference of opinion prevails. The disease seems to have been observed by, and to have been familiar to the ancient Greeks. They regarded it as a scourge from heaven, or from their enraged deities; and therefore did not trouble themselves in the investigation of its nature and cause. It was also familiar to the Romans, under the name of *Rubigo* or rust. Dr. Kieth has endeavored to point out at least three species: 1st, blight arising from cold and frosty winds; 2d, from a peculiar vapour, perhaps originating in certain electric conditions of the atmosphere, and 3d, from the presence of

small parasitical *fungi*." And, while these relate more particularly to plants, yet they produce the same effects on trees and shrubbery. But old and authoritative as these views are, and injurious as the effects arising from these causes may be, they do not explain the cause of our modern fire-blight, which often comes suddenly—in one night—affecting a single tree, or a single branch of a tree, whilst all else is healthful and untouched. In the specimen exhibited at the meeting of the society above alluded to, although the leaves were a dark brown—almost a black—the wood was green and apparently healthful, and another member stated that he had seen early blighted branches drop their leaves, and push out fresh leaves in the same season.

HORSE SHOES AND HORSE SHOEING.

BY GEO. FLEMING, VETERINARY SURGEON OF ROYAL ENGINEERS.

In this country (England) towards the end of the last and commencement of this century, an attempt was made to place the art of horse shoeing on a scientific basis, but, unfortunately wild theories with regard to the functions of the horses' feet were promulgated; the hoof alone was studied and no regard was had to the important structures it contained and to which it was a mere shell; fantastic notions as to the expansion of the hoof at the heels, the descent of the sole, and other strange ideas were carried into practice, and shoeing on what was and is still termed "improved principles," though the improvement was an infraction of nature's laws—proved a veritable curse to horses. The hoof was reduced to the thinnest film where it should have been left strong, and was pared away until it yielded on the sole to the pressure of the thumb or until the blood came oozing through; a knife was devised to search into the inflections of the heels, which were so many natural bulwarks, and the elastic cushion at the back part of the hoof was recklessly sliced away until at last the foot was so robbed of its natural covering, that it required great skill and an artificial protection between it and the shoe to enable the animal to travel for a few years. The shoe was beveled off on the upper surface so as not to press in the tender sole, and thus threw all the strain of the weight and exertion upon the margin of the foot. In short, no treatment devised to ruin horses prematurely in their feet could have been more appropriate and successful, so far as the lower surface of the hoof was concerned. With regard to the outer part, this was rasped and chiseled away to make fine work until there was scarcely sufficient material left to drive the nails through, consequently these had to be increased in number. The evils horse shoeing thus introduced have continued and are as prevalent now as they were fifty years ago. The number of horses rendered useless by "improved" farriery is very great, and only too frequently inefficiency is brought about at an early part of the horse's career. The farrier only too frequently work by rule of thumb and on no fixed principle. Their knowledge is mainly traditional, passed from father to son or from an elder to an apprentice, without cultivation or without being enhanced by educated observation. This is due to the neglect into which the art has fallen for many centuries; and yet the neglect is somewhat unpardonable. Not very many years ago the farrier was the only authority on the diseases of animals, and to his tender mercies were en-

trusted their restoration to health and soundness when they were sick or lame. Science has relieved him of this responsibility and transferred it to the medically trained veterinary surgeon, who from his general and professional education should be better fitted for such a duty; but this depreciation has still further lowered the *status* of the farrier, and it is to be feared his art. While the veterinary surgeon, from the many subjects he has to study while in college, and, the far too brief period he spends there, has no time to acquire even elementary notions of the horses' foot, and the best means of keeping it sound. He therefore imagines that this is a matter of but little moment, and I fear some members of the veterinary profession think it rather degrading to pay any attention to what they consider such an humble, mechanical handicraft. This is deeply to be regretted, when we know how many horses are prematurely ruined through mismanagement of their feet; how many suffer the most horrible torture, for perhaps years, through bad shoeing, and how many are rendered more or less inefficient and worn out in their limbs from badly adjusted, ill-constructed and far too heavy shoes. There is no remedy for this unfortunate state of affairs, but teaching the farriers their art in some school or college presided over by competent teachers and licensing them when they are able to carry the principles they have been taught, into practice. A certificate of competency would be a guarantee that the possessor had directed some attention to the theory of his art, and was so far acquainted with the anatomy and physiology of the organ with which he had to deal, that if he could not heal it as a surgeon when it was diseased, he would yet be in a position to prevent much disease in it. It does seem strange that in a country like our own—the home of the best and most valuable horses in the world—and among a horse-loving people such as we are, some such an establishment has not been instituted. If the society of arts wished to confer a great service upon horse owners, and upon the noble beast himself, and through them upon the entire public, it could not do better than provide a scheme for supplying educated farriers to all parts of the country. The society would have abundant support, and nothing would tend more to improve the minds and elevate the position of the farriers themselves.

Though the end of the horse's limb is named the "foot," yet it has no analogy to the human foot except that both rest on the ground, and are essential instruments in progression. The fore foot of the horse is in fact the extremity of the middle finger of a man's hand, and the hind foot the analogue of the middle toe of his foot; while the nail represents the horse's hoof. In this way the horse's knee is the human wrist, and the hock the human ankle and heel. It is sometimes useful to bear this distinction in mind. A sort of conical semi-human bone fills the anterior two-thirds of the hoof, and to it the hoof is moulded as well as firmly attached.

This is the "foot bone"—admirably adapted for its purpose in being light yet strong, and affording ample protection to the large blood vessels which supply the organ in such profusion. Above this bone is the small "pastern bone," and behind it and between the wings of the crescent is another narrow bone—the "navicular" or shuttle bone, as the old farriers used to name it. Over this bone the powerful flexor tendon of the foot passes, to be inserted into the lower surface of the foot bone; and this tendon again rests upon and is supported by, at this, its weakest part, a large mass of elastic substance which plays a very necessary part in the function of the foot. From each round of the foot bone spring two wide cartilaginous plates connected with the elastic cushion; and these rising above the heels of the hoof have a large share in promoting springiness and obviating the injury to the organ. The whole of the foot within the hoof is covered by an exquisitely sensitive membrane which secretes the horn. The "hoof" consists of three parts—wall, sole and frog. The wall is attached to the foot bone by means of a very large number—over six hundred—of very sensitive vascular leaves which run from above to below, and are received between similar but horny leaves on the inner surface of the wall. The union is of the most instructive and beautiful character, and I regret that time will not allow me to show how wonderfully adapted it is for the end in view. The "wall" itself, as is indeed the whole of the hoof, is composed of very minute cells, not unlike those which compose the skin, but differently arranged to form fibres which pass from the top to the bottom. These fibres can be distinguished by the naked eye on a very close inspection, and to form them the cells are laid lengthwise or vertically, while the fibres themselves are united by inter-fibress cells which lie horizontally, so that we have cells laid in two directions; and this not only affords a better resistance to wear but prevents splitting.

The wall grows from the "coronet" or upper part of the foot and this growth is incessant. The outer or surface fibres are very dense and smooth, but the deeper they are situated the more soft and spongy they become—a fact of much importance in shoeing. At its upper part the wall is covered by a soft elastic bone which protects it while it is being formed. The sole is formed of fibres passing in the same direction and constructed in the same manner as in the wall, but it differs from the latter in one important point, When it has attained a certain thickness, the superficial horn becomes detached in flakes, which, even in a semi-detached state serve as useful purpose in retaining moisture for the growing bone beneath, and acting as a springy defence against injury from loose stones. The wall on the contrary grows to an indifferent length, or rather depth, when it is not worn away by contact with the ground—another important fact to be remembered. The frog is also fibrous but the horn of which it is composed

is different in quality, being soft, dense and elastic like India rubber. It is an essential constituent of the elastic apparatus of the foot of the dog, cat and other animals, and a cushion beneath a man's heel. The elastic apparatus of the foot also consists of a springy material around the top of the organ, and which fits into a recess at the upper margin of the wall, so that we not only have elastic cartilages and cushions at the back part of the foot, but an excellent contrivance all around the top, to break the primary shock of contact with the ground.

The fore foot when well formed is nearly circular in shape, but the hind one is oval, otherwise there is not much difference between them. The angle or slope of the wall varies, but it is generally between fifty and fifty-two degrees. This is as much of the anatomy of the foot as we now have time to notice; but I may tell you that perhaps no organ of the animal's body will better repay a careful study, if only to trace the evidence of design so wonderfully displayed in every part and combination of parts. With regard to function, it may be sufficient to mention that the ball sustains the largest portion of the weight and is the part chiefly exposed, as it is that which is mainly designed to encounter wear. The sole also shares in weight bearing, but a wider surface participates on soft than on hard ground owing to its concave shape. The frog has also to sustain weight to a great extent, but its most important duty is undoubtedly to support the flex or tender of the foot through the intermediate cushion, to prevent slipping and also to assist the animal in suddenly checking its pace when moving rapidly. The lower border of the hoof does not expand to any appreciable extent when the animal is in motion. For years this has been taught, but it is a fallacy and many circumstances prove it to be so. The expansion takes place at its upper border and towards the heels where the chief elastic apparatus is situated. The function of the fore foot is chiefly to support weight, that of the hind foot is to propel the body. Now as to shoeing. It is obvious that the horse's foot was designed to meet every natural demand so far as the animal's weight and movement are concerned; but when a heavy load is imposed on his back, or attached behind, and when he is compelled to travel, particularly over hard roads in all kinds of weather, nature's arrangements are overtaxed and the wear of the hoof is greater than the repair. Consequently art must step in to assist nature. The part of the hoof which suffers most from undue wear is that which was intended to encounter it, the wall, and when this is too much worn the sole becomes broken around its margin and the sensitive parts within wounded and contused. Therefore all that the hoof requires in order to enable the horse to remain serviceable is merely some kind of protection for the lower border of the wall, but this protection should not be heavy else the muscles which

were designed to move a marvelously light foot will be unduly strained as will also tendons and ligaments, for the muscles—the moving power of the limb—are all situated in the upper part of the leg, and act upon short levers, the mechanical means being designed rather from speed than strength. The protection must be durable ; it should not damage or interfere with the functions of the foot, but allow every part to perform its office unimpaired ; it ought to be easily applied and secure when attached to the foot ; it should not render the animal less sure footed, if possible, than before it was applied, and finally it ought to be simple and cheap. Grave charges have been brought against this method of preserving the hoof from the effects of wear by men whose absurd theories when carried into practice inflicted most serious injury to the foot ; but we may dismiss these and all other charges by the declaration that it is not the use but the abuse of the method which is inveighed against. The abuses are due to the farrier trying to improve, not assist nature, and to make improvement costly. The most serious abuse is the very unreasonable and barbarous mutilation of the foot. This is often carried to an excess scarcely credible. The sole is robbed of its natural protection until it yields to the pressure of the thumb, and even until the blood is passing through it. The frog is cut away to a shred to make it look neat ; the bars are carefully removed, and then a shoe is put on much too small for the hoof. This leaves a portion of the wall projecting beyond the outer margin of the metal, and to make the foot fit the shoe the horn is removed by means of a rasp from the front of the wall, which is consequently considerably weakened at the very part where of all others it should be strong, to support the nails which retain the shoe. Not only this but the dense resisting fibres being removed the soft springy inner bone is exposed, and thus being acted on by external influences, cracks, splits, until there is scarcely any sound material to retain the nails, which have consequently to be driven higher and nearer the sensitive parts, and this in turn leads to disease and deformity. A hoof so maltreated has a remarkably ugly ragged appearance. In addition to this mutilation of the hoof in the vicinity of the shoe, the farrier, in order to complete a fine job as he imagines it, rasps the outer surface of the wall as high as the nail, and in this way not only destroys the horn thus rasped, but impairs the growth of that from the coronet, which becomes weak and brittle, so that at length the workman has to employ his utmost skill to fasten on the shoe without laming the horse, and has also to employ a greater number of nails which immensely exaggerates the evil. These mutilations and their consequences are quite common, and we can scarcely pass a horse in the streets of London without noticing them, and the majority of the shoes which are applied to the hoofs are no more reasonable in their construction. Great clumsy, unsightly masses of iron, the weight

of which is perfectly outrageous, are attached to the feet of horses which have to travel sometimes at a rapid pace conveying or drawing heavy loads.

This weight is not only injurious to the feet through the strain it imposes on them, but it is extremely fatiguing to the muscles, so that a large proportion of the animal's power is expended in carrying about unwieldly clogs of iron. And the useless weight is not the only objection to very many of the shoes in daily use. In order that the denuded sole receives no injury from the pressure of the shoe this is beveled away on its upper surface until there is only a narrow rim left on which the foot rests, so that in reality the whole of the weight bearing is thrown upon the wall, and in consequence of the thickness of the shoe, neither sole or frog ever come in contact with the ground and sustain a fair share of the weight and strain. In this way the horse is compelled to travel as no other animal does or was designed to—on the outer margin of his foot. The space between the shoe and sole is admirably fitted for the lodgment of stones, dirt, &c., and in heavy stiff ground wonderfully increases suction. So much for the upper surface of the shoe. The lower or ground surface is not much less defective. It is usually a large, wide, smooth surface of metal, well contrived to promote sliding and slipping, furnished with a groove near its border in which the nail holes are punched, but which groove is a mere waste of labor and time for the farrier to make as it is useless. Sometimes with a view to prevent slipping two projectors or "calks" are raised at the end of the branches of the shoe, and these though they may to a trifling extent answer their purpose, nevertheless throws the foot and limb into a most unnatural and uncomfortable position, the pain and inconvenience of which we may realize by walking in very high heeled boots. These are only some and not all of the evils of shoeing commonly practiced, and it must be confessed that they are very serious, and sooner or later lead to painful traveling for the horse, as well as impaired efficiency, and yet this art which the farrier makes so difficult and costly, both directly and indirectly, should be neither.

To shoe a horse properly, if we take observation and a study of nature's plans into considertion is certainly not a very difficult operation and neither need it be a very expensive one. One object should be to protect the hoof from wear—nothing more; and in doing so we ought to maintain the integrity and soundness of the hoof, while we do not overburden or disturb the natural directness of the foot or limb, and as a secondary object, we should endeavor to increase the animal's foothold on the ground if possible. The first object is attained by leaving the sole, frog and bars in their natural condition; as I have explained that when they have acquired a certain thickness the outer surface falls off in flakes of dead horn so that they never

become too thick. It is different with the wall, which would grow to an indifferent length, because it is not thrown off in flakes and the shoe prevents it from being worn. This, therefore, every time the horse is shod has to be reduced in length at its lower border to a degree corresponding to the growth which has taken place since the previous shoeing; and the manner in which this is done, as well as the extent, constitute, in my opinion the *chief* test of the farrier's skill. If the wall is too much reduced generally, injury will follow; if too much at toe or front, the heels will be unnaturally high and this will alter the animal's gait, partially in the fore feet and make its pace uncomfortable to the rider; if too much at the back part of the heels it throws unnatural strain upon the fetlocks and other joints; and if one side is lowered more than another it leads to twisting of the limbs and strain of the lateral ligaments of the joints. All these can be avoided by the skillful artisan, and yet strange to say the normal position or structure of the foot and limb is seldom taken into consideration, and we see numbers of horses of all descriptions with these more or less crooked in consequence.

The unmutilated hoof only requires as much iron as will protect the lower border of its wall, say for a month or six weeks, and insure the security of foothold—nothing more—and all beyond this is loss and injury, while if possible the sole and frog should be allowed to play their part. A shoe and method of shoeing which admirably answers these ends, is that introduced some years ago by M. Charlier, a Parisian veterinary surgeon. A narrow rim of iron is imbedded in a recess formed by removing the wall only to a certain depth of its lower border; the iron in fact takes the place of the removed wall and is retained securely by a small number of very small nails. The first I believe to try this method of shoeing in this country, I have continued its use but in a modified form, up to the present time and can affirm that it is, for many horses, the best method of shoeing known. In principle it is founded upon a sound physiological basis, and in practice I can testify to its great utility. My modification consists in having only a short rim of metal passing around about two-thirds of the wall and imbedded on a level with the sole, leaving that and the frog to reach the ground, and heels free from iron in all respects indeed, as if the feet were in an unshod state. The rim weighs about one-third of the common shoe and is retained firmly in position by only four of the very smallest nails, and yet it wears longer than the heavy shoe which requires eight, ten and sometimes twelve nails. This is easily accounted for by the fact that the horse and iron wear together in this instance, and that the limbs are not fatigued, but move lightly and easily.

Traveling is also safer on slippery roads, as there is only a very small portion of metal exposed and the frog prevents slipping. The saving in

manufacturing nails and iron is also very great. If this shoe cannot be employed then we ought to resort to one in conformation the opposite of that now adopted, in so far that it should be much lighter, be concave on the ground surface and flat towards the foot, and instead of having a groove, have merely the nail holes punched for the reception of the nail head. This would assure a safer footing, diminish the strain on the wall by allowing the sole to share in sustaining the weight, as it was intended it should do, and obviate the effects of suction in heavy ground as well as picking up stones, &c., &c.

A shoe I have devised meets these ends and is merely an imitation of the lower border of the wall, sole and bars. I have tested its utility among troop horses and in the hunting field for a number of years, and it has proved a good shoe for road work. The bevel on the ground surface suddenly ceasing within an inch or two of the branch leaves a catch which imitates the angles of the bars, and acts like them in assisting the horse to check his motion suddenly.

The nails should be as few and as small as possible, and be driven only a short distance into the wall, which if reduced to its proper dimensions before the shoe is put on will not and ought not to receive any further rasping, especially on the face, as the shoe should be fitted to its circumference. A word as to fitting. To secure a perfect coaptation between the shoe and hoof is not an easy matter, and requires time and tact, and when it has been obtained the shoe is far from being as securely attached as is desirable, particularly if the hoof is exposed to wet. The fitting is greatly simplified, and an accurate adjustment as well as solid surface on the shoe secured if the latter be used in a hot state to prove the evenness of the surface on which it is to rest, as well as to fuse and char the immediate ends of the fibres, which are thereby hardened and resist pressure and the effects of moisture to a wonderful degree. Persons ignorant of the subject imagine this injures the foot, but in all my experience I have never observed any harm to follow. Horn is a slow conductor of heat, and provided the shoe is sufficiently hot to leave its imprint when momentarily applied, and the hoof is not mutilated to a shred of horn, no injury can or will follow. With regard to security of foothold and adding to the horse's power in draught, particularly with those horses which travel at a slow pace with heavy loads in our cities there can be no doubt that "calks" are necessary, but their utility is greatly diminished and they do harm to the limbs and joints if a toe piece is not added. In nearly every town and city in this country except London, the "claw shoe," as it has been termed, is in use, and without it the horse would be much more liable to falls, and would draw much less loads with quite as much fatigue. This shoe is not worn in London, and we see horses not drawing half the loads those in these places do, and

yet are scarcely able to keep their feet. Surely this is short sighted policy. With a toe piece the hard foot of the horse has a powerful aid in seizing the ground securely, and its propelling muscles can be then brought into full play in moving the load to which it is attached, instead of expending half its force in maintaining an equilibrium. Various contrivances have been from time to time proposed to give the horse a better foothold, but none have proved so successful and as cheap as the calks and toe piece. In connection with this subject of slipping, which is chiefly observed in the streets of our towns and cities, it must be confessed that the manner which these are paved only too frequently does us little credit as a humane or economical people.

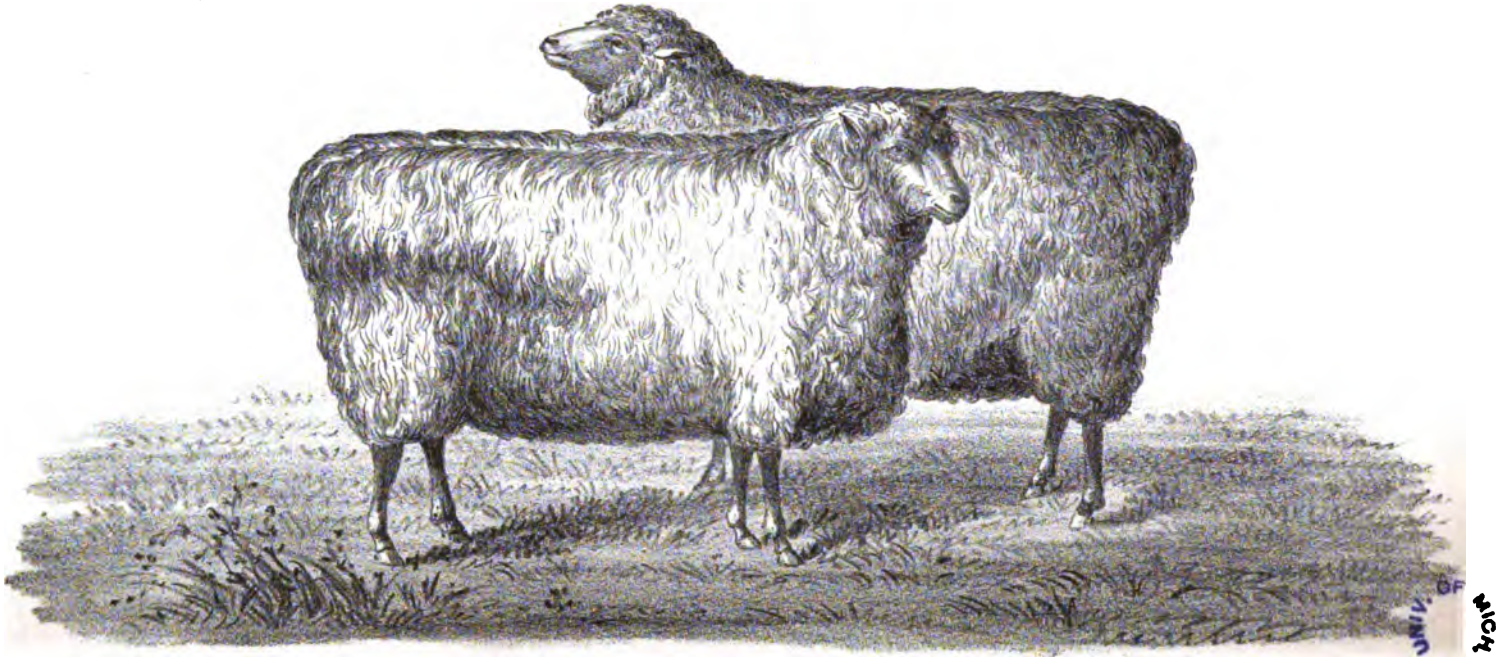
Certainly economy has much to do with this construction, but it is short sighted economy and chiefly in form of the taxpayer—not of the community in general nor yet of horses. Indeed looking at the variety of pavements and the difficulty in the matter of traffic, one must feel that the horses which have to travel on them must be greatly perplexed, and if they have reflective power they will doubtless consider the masters as very stupid and embarrassing road makers. Some of the streets of London are infamously cruel to horses. Those paved with granite may be cheap to lay but they are objectionable in every respect, and the most expensive of all to horses and carriage owners. They are at all seasons very dangerous and fatiguing to horses in the matter of slipping; they inflict great injury to the limbs and feet from concussion; traction upon them is heavy; they are extremely noisy and the jar and vibration they occasion carriages wear these out more rapidly than any other kind of road. When wet and muddy they are as dangerous to human passengers as to horses. In fact though granite blocks make a very durable pavement yet, on the whole, looking at such a pavement from an equestrian point of view, it is the most expensive and dangerous of any in use. With regard to macadamized roads there is certainly a better foothold upon these but their traction is heavy; in wet weather this is increased and the result is most objectionable, while in dry weather the dust is a great drawback and watering is a nuisance and expensive; noise is also considerable and repair must be frequent. The asphalt pavement is in many respects objectionable, traction is no doubt easy but when the pavement is damp there is no foothold for horses and the danger from falls is great. It is not a noiseless pavement; sprinkling sand over it to render it more safe increases the noise and traction. Besides asphalt does not at all answer on hilly streets. The best pavement perhaps ever introduced for horse traffic is that of wood such as is laid down at Ludgate hill. From the fact that the cubes of wood are so laid that the fibre is vertical, that the interspaces are filled with pitch and gravel, and that they are laid upon diagonal planks, we have not only a very safe and comfortable pave-

ment, so far as the horse's foot hold is concerned, but the nature of the material and the manner in which it is disposed render it a most humane roadway, with regard to obviating jar and concussion to the feet and legs. Traction upon it is easy. There is comparatively little noise, dirt and dust, and although for the human and equine population of our towns and cities perhaps no more economical, safe and agreeable pavement could be devised. The farrier must do his best to preserve and protect the horse's feet by shoeing, but we have a right to expect that the engineer will not fail to second his best efforts by constructing roads which, while insuring safety to horses traveling upon them, will not counteract the advantages of good farriery. The more frequent use of "breaks" for carriages, and particularly for omnibusses, in pulling up suddenly and also in going down hills, would prove of great benefit to horses, in connection with shoeing and slipping; and passing along the streets of London one is astonished to observe that the most economical and humane contrivances is not in greater request. This matter of roads and brakes for carriages is one of great importance, but particularly the former. It is painful to witness unprotected horses unable to keep their feet on the horrible pavements with which a majority of our streets are laid, and brutal drivers plying their unmerciful whips on the poor creatures' skin for no fault whatever, but merely because a stupid and mistaken economy will persist in constructing a particular kind of road upon which it is impossible the animal can travel with anything like safety, and at the same time exercise their powers of draught. This consideration brings me to "winter" or "frost" shoeing. In a climate so uncertain and fickle as this is, it is difficult to make anything more than a guess as to the kind of winter we may have in any year, and therefore no provision is made against the occurrence of frost. Indeed, in some winters we may have no frost at all, and the ordinary shoeing suffices for the whole season; but at other times the temperature may suddenly fall and frost and snow appear, and then all is confusion, partial suspension of traffic, dangerous traveling, serious accidents and such other incidents as the last winter provided in abundance. The ordinary method of "roughing" the shoes, at it is termed, consists in taking them off the feet, turning up a sharpened calk, and perhaps adding a sharp toe piece, and putting them on again. This is a slow and expensive process and of course requires the aid of a farrier either in the stables or at the forge; it is very injurious to the hoofs, takes a good deal of time and in consequence of the projections being soft iron, must be repeated at short intervals. Besides in the hurry which always exists at the time, the shoes are often badly put on and get loose or are lost, or the nails are driven into the quick. To obviate all these disadvantages and inconveniences, various contrivances have been proposed. A very temporary

one consists in inserting some large sharp headed nails in place of the ones withdrawn. These also injure the hoof. Another is the insertion of sharp studs screwed on at the heels of the shoe. These are convenient but somewhat expensive, and are liable to break at the neck, leaving the screw portion immovably fixed in the shoe. Other more or less expensive and inefficient appliances have been proposed and have not succeeded in meeting the requirements of those whose horses must do regular work during frost. This winter shoeing has attracted my attention for years. During a campaign it is sometimes of the utmost importance to the army that the horses should be able to travel on ice—indeed the fate of an army or the success of some great movement may depend upon it. I may point to the French retreat from Moscow, in 1812, as described by Theirs, where the terrible disasters that occurred were largely due to the absence of some contrivance for enabling the horses to travel on slippery roads.

We may also read with profit the Danish retreat from Schleswig to Soudersburg, on the night of February 5th, 1865, as given in the *Times* of the 18th of the month. I have tried every method proposed but have found none which was economical, efficient, and speedily applicable when required and without the necessity of taking off the shoe. Three years ago I ventured to experiment with a method which has certainly proved to be the nearest to perfection in these respects. During last winter it was very extensively used and reports were most favorable. The method consists merely in punching a square hole at the end of each branch and if thought desirable, at the toe of the shoe, and inserting into it a square, slightly tapering plug of steel with a sharp point projecting beyond the lower surface of the shoe. The plug may be any reasonable length, from one to three inches, but it must fit the hole somewhat accurately and tightly, and must not go quite through the shoe to the hoof. It may be tempered at the point to give it durability, and nothing more is necessary than to insert it into the hole, give a slight tap at the point to fix it until the horse puts its weight on it and drives it home; when it is firmly retained, each step keeping it tighter in.

This stud rarely falls out if properly made, and when required to be removed as to be re-sharpened, replaced by another, or left out altogether, a few taps on each side will generally start it—owing to the taper of that portion which fits into the shoe. This is a very inexpensive plan. An old horse rasp, value three pence, will make eighty-two studs, and a farrier can furnish them in an hour. A set of studs will last four or five days, and the simple square hole it takes but little time to punch. At the commencement of winter—say November—all shoes put upon my troop horses are provided with these holes, and the farriers have their studs ready. Should frost suddenly set in, all the horses can be made proof against slip-



UNIV. OF MICH.

QUEENS OF THE FLOCK.

1st Prize Yearlings at London Show, England. 1872.

Owned by T. S. Cooper, Linden Grove Stock Farm,

Coopersburg, Pa

ping on a sheet of ice, even in a few minutes, and with a good supply of studs may travel for weeks without going to the forge or requiring the farrier. When the frost disappears the studs can be taken out again, and they may be removed every night in the stable, and inserted in the morning before going out to duty. I must now conclude what I have to say concerning horse-shoeing in general, and the principle on which it should be based. I have made no mention of the different kinds of shoes sometimes required for particular hoofs, but whatever may term "pathological horse-shoeing," for the cure of disease or defects, natural or acquired, of the feet and limbs. This, though most interesting and important section, nevertheless comes within the domain of the scientific veterinary surgeon, and is of too extensive and perhaps technic a character to be introduced to your notice after what has already been stated.

CATTLE FOOD AND CATTLE FEEDING.

BY THOS. J. EDGE, LONDONGROVE, PA.

The Pennsylvania farmer who fattens cattle for beef has three sources from which he may look for profit or to which he may charge his loss, viz: gain in weight, increase in value per pound and increased value of the manure. His far western competitor must confine his attention to two of these sources, gain in weight and gain in price per pound, for to him the manure has little or no value; the English feeder must depend upon the gain in weight and increased value of the manure, for in the usual condition of the markets he must sell for about the same price per pound as he gave. The western farmer with his large crops of cheaply produced corn has an advantage in some respect, and the peculiar climate of England by permitting the growth of a varied crop of roots enables her feeders to choose from a much greater range of foods. In our own State it does not seem that the root crop is able to compete with grain when the disadvantages of climate and high priced labor are against them.

Food is of course only valuable for fattening in proportion as it is easily digestible, but all the best of our authorities agree that a certain portion of indigestible material is absolutely needful to keep up a healthy condition of the digestive organs. Careful experiments and chemical analyses have enabled us to determine very nearly not only the amount of digestible material in each kind of food, but also its fattening power and manurial value. A careful comparison of the different values as shown by analysis and also by experiment from the most reliable sources, has enabled us to establish the following table of nutritive values; the first column of which contains the number of pounds according to value by analysis, and the second the number of pounds as ascertained by the average of a number of actual experiments; the figures in the two columns represent also the amount of each kind of food which is equal to each of the others, or to one hundred pounds of good meadow hay:

Meadow hay	100 pounds		100 pounds.
Clover "	77 "		95 "
Rye straw	502 "		355 "
Oat "	364 "		220 "
Ruta bagas	676 "		262 "
Field beets	391 "		346 "
Carrots	412 "		280 "

Potatoes	324 pounds		324 pounds.
Beans	29 "		46 "
Peas	30 "		44 "
Indian corn	70 "		56 "
Barley	65 "		49 "
Rye	58 "		49 "
Oats	60 "		59 "
Buckwheat	74 "		64 "
Wheat	47 "		43 "
Oil cake (linseed)	22 "		64 "

This table is, of course, most valuable for its advantages of comparison; the value and proportion of the different kinds of food so much depend on condition that it would be almost impossible to prepare a table of such equivalents which could be taken as accurate. From this table we may assume that one pound of corn is equal to six of rye straw, or three and one-half times as much of potatoes, or four times that weight of oat straw.

As before stated it is but reasonable to suppose that there should be some kind of connection between the value of a given kind of food and the amount of nutriment therein that is digestible, for it is only this which can be appropriated by the animal, and after supplying the waste of the system go towards adding fat and muscle. After a large number of experiments, both theoretical and practical, at one of the principal German experiment stations, Dr. Wolff has prepared a table showing the comparative values of the different kinds of food as based upon the amount of digestible material which analysis shows them to contain. The amount taken in each case is one hundred pounds, and here this table, like the preceding one, may be taken as one of comparative values also:

Meadow hay, (poor)	38 lbs.
Meadow hay, (average)	41 "
Meadow hay, (good)	49 "
Clover hay, (poor)	43 "
Clover hay, (average)	46 "
Clover hay, (good)	48 "
Timothy hay	49 "
Wheat straw	32 "
Rye straw	40 "
Oats straw	40 "
Barley straw	40 "
Corn fodder	38 "
Corn	70 "
Oats	54 "
Potatoes	23 "
Turnips	7 "

Carrots	12 lbs.
Sugar beets	16 "
Field beets	10 "
Cotton seed cake	46 "
Bran	50 "
Red clover, just before blossoming	10 "
Red clover, in full blossom	11 "

It does not follow that because a given proportion of the food is digested that the animal will digest and appropriate it all; much will depend upon the digestive powers and the condition of the health of the animal on which the test is made. It is also reasonable to suppose that the result would depend somewhat upon the amount fed at one time, and that the same animal would not be able to digest as much from one large feed as from the same amount fed at two distinct feeds, and no doubt after certain limits are reached this is correct, but the German experiments seem to prove that an animal will digest twice as much nutriment from all the hay he will eat at one feed as from the same divided into two or more feeds. In basing our table of values upon the amount of digestible material in the different classes of food, it must be remembered that much depends upon the condition in which the crop was secured, and the time of growth at which it was harvested; the experiments of Wagner prove that while a given amount of red clover cut before it was in blossom made 85 pounds of hay which contained 47.5 pounds of digestible material, an equal amount cut when in full blossom made 114 pounds, which contained 61.6 pounds of material, which was applicable to the wants of the animal by being digestible, while a third and equal amount cut when dead ripe made 128 pounds of hay containing 59.3 pounds easily digestible. Valuing them by their chemical constitutions Wagner assumes that when made into hay the first was worth 72 cents, the second $1 05, and the third but 94 cents currency. In this point practice will bear the chemist out to the full extent, for we all know the loss sustained by allowing any kind of provender to become fully ripe; a large proportion of that which if cut at the proper time would have been nutritious, is changed to indigestible woody fibres. In this connection Wagner suggests that if it is intended to cut the second crop of clover for hay it will be found most profitable to cut it just before it is in full blossom, for the loss which is then sustained will be more than made up by the increased length of time allowed for growing the second crop to which he assigns three weeks—a period too long for our experience.

Taking the tables of Wolff as our guide, we may assign the different kinds of food a position with reference to their fats at the following rate per hundred pounds:

Meadow hay, (poor)	0.5
Meadow hay, (average)	0.6
Meadow hay, (good)	0.9
Clover hay, (poor)	1.0
Clover hay, (average)	1.2
Clover hay, (good)	1 7
Timothy hay.	1.4
Wheat straw	0.4
Rye straw	0.4
Barley straw	0.4
Oat straw	0.4
Corn fodder	0.3
Corn	4.8
Oats	4.7
Potatoes	0.3
Turnips	0.1
Carrots	0.2
Sugar beets	0.1
Cotton seed cake	9.9
Bran, (wheat)	3.7

In considering the value of foods with reference to the fat element, it must be remembered that chemists divide them into three distinct classes of constituents, viz: Albuminoids, carbo-hydrates and fats, and that if the fats are not furnished in this state in the food the animal has power (if a surplus beyond the actual wants of the system has been furnished) to change the sugar and starch of the carbo-hydrates into fat forming material, and in some cases it may be more profitable to furnish this in the carbo-hydrate form than in the form given in the table, in such cases the supply must of course be increased proportionably. In proportioning these several elements it has been found by careful tests made and re-made at all the German experiment stations, that the average animal must have about 24 pounds of organic material for each 1,000 pounds of its live weight, and that of this 24 pounds there should be 2.5 of albuminoids, 12.5 of carbo-hydrates, and 0.4 of fat. To obtain these the animal must consume 30 pounds of good hay, 120 pounds of young natural grass, 154 pounds of young clover, or 40 pounds of poor hay. To the American farmer who is little used to experiments of the kind this may seem useless matter, but by practical test it has been more than once proven that a cow will give as much milk, and do as well in every particular if fed on 87 pounds of green clover and 6.5 pounds of dry rye straw as if fed 123 pounds of pure clover.

In fact we may assume that the important item of properly regulating and mixing the food of our farm stock, though even there but imperfectly

understood, is better known in Germany than in any other country, and that her experiment stations are working out the problem slowly but surely.

While we may safely assume that the fattening value of any kind of food depends upon the proportion of digestible matter which it contains, it is quite easy to imagine that its manurial value may in great measure depend upon its indigestible portions.

One ton of ordinary barn yard manure, when dry, to an average degree, has been found to contain of—

Water	1,589 lbs.
Carbonaceous matter	272 "
Nitrogen	8 "
Potash and soda	11 "
Lime	12 "
Magnesia	5 "
Phosphoric acid	4 "
Sulphuric acid	3 "
Chlorine	1 "
Silicia or sand	89 "
Oxide of iron and alumina	6 "

It is needless for me to tell practical farmers that the manure made from cattle varies very much in value with the food which has been used, and that the manure of grain fed cattle is much more valuable than from those which have had none, or that the manure from a ton of clover hay is worth more than that from a ton of corn fodder or oat straw; but how much more valuable it is?

In order to answer this question, J. B. Lawes, (the highest authority in England, if not in the world,) has after repeated analysis and actual experiment constructed the following table of the value of the manure made from one ton of each kind of food:

Cotton seed cake	$27 86
Bran	15 75
Peas	13 38
Oats	7 40
Wheat	7 08
Corn	6 65
Barley	6 32
Clover hay	9 64
Meadow hay	6 43
Oat straw	2 90
Wheat straw	2 68
Barley straw	2 25

Potatoes	$1 50
Marigolds	1 07
Turnips	86
Carrots	86
Rutabagas	91

As the value of the manure will of course vary in different neighborhoods, and with each variation in the cost of the food, these figures of course only furnish us with the means of comparison between the various kinds; for instance, we may thus assume that the manure made from one ton of clover hay is worth more than that made from four tons of wheat straw, or six tons of potatoes, or eleven tons of common turnips.

The practical feeder is well aware that the mode and manner of feeding has much to do with the result and effects, not only the fattening value of the food, but its manurial value also. No matter what the kind of food, whether easily digestible or not, whether rich or poor in fats, whether cheap or dear, its nutriment is in the form of microscopic globules, each of which is enclosed in a minute sack of partially undigestible material; until these sacks are in some way broken, the animal cannot obtain and appropriate the nutriment and it is to the *economical* rupture of this covering that the wide-awake feeder will direct his attention; no after operation can add anything to the nutritive in grain, corn or grass; it can only make that which is already there available. When whole grain or hay is fed, a portion of these cells are broken in the process of mastication and remastication, another portion are broken by the fluids and heat of the stomach while a third and variable portion escape all these agencies, and, as far as fattening the animal is concerned, are lost. By the operation of grinding our grain or cutting our hay we not only relieve the animal of much labor but also more effectually release the nutriment of the food. Heat is another and even more active agency, and it is doubtful if there is much nutritive, well cooked, fairly ground meal, which can possibly escape the digestive organs of the animal, of course such parts as are indigestible even heat cannot make available.

If these aids to digestion cost more than the value of the food rendered available or saved by them, they cease to be economical and will be abandoned. Thus on the prairies of the west, where corn is cheap and mills are distant, it does not pay to have the corn ground, for the amount saved thereby will fall short of paying the toll and expense of hauling. In our own State there seems to be no division of sentiment among our farmers as to the economy of grinding all kinds of grain, but if we may judge from the discussions of our farm clubs we may suppose that the question as to the economy of steaming or cooking is a much more close one and difficult to decide. The point is not whether steaming will or will not save

a certain portion of food by making it more easily digestible, but it is whether this does not cost more than the food thus saved is worth. Having once had all the symptoms of the steaming fever, (without having the disease in its worst form,) I feel able to say that in my own case it cost so much that it did not pay, and among our Pennsylvania farmers I do not know of any who having commenced steaming hay and fodder have continued the practice for a long series of years, but sooner or later all abandoned it, some for one reason and some for another, and a few simply because it does not pay.

In many cases in giving the results of such experiments the comparison has been between cut hay or fodder steamed, and *uncut* hay or fodder fed uncooked; had the test been between cut hay or fodder steamed, and cut hay or fodder unsteamed, it would have been shown by the results that much of the gain was due to the cutting, and that this would rob the steaming of enough to reduce the profit below an economical point.

Another item of some importance in the manner of feeding is the mixing of the meal with cut hay, fodder or chaff. In the discussions which ensue on this question, all admit that the coarse food goes into the first stomach or paunch for remastication previous to digestion, and that dry meal if fed alone passes direct to the fourth or true digestive stomach without the intervention of the other three. On one side of the question it is claimed that by mixing the meal with cut hay and chaff, the animal is compelled to take it into the first stomach, and that after being properly moistened it is with the hay again passed into the mouth for remastication, and that thus remasticated is important in making it more easily digestible.

Other good authorities claim that the office of the second or smaller stomach is to receive the material from the first in small quantities, and after separating the coarse and fine particles by washing them out, to pass the finer parts on to the third or fourth stomachs, and the coarse back to the mouth to be again masticated and more thoroughly moistened with saliva. The question involved seems to be one of physiology, and having satisfied myself (by experiment) that there is a gain to be obtained by thus mixing, I am content to leave the question for those more competent to decide.

Much has been said and written on the subject of the amount of exercise which a fattening animal should be allowed to take. From experiments made by Col. M'Donald, of Logan, Scotland, it would seem that confining each animal in a small and separate pen was more profitable than either stalls or open sheds. In this, as in many other things, I think that we will find that the golden mean between the two extremes is the best, and that our feeding cattle if properly protected from storms are all the better of a

small amount of exercise, but that there is a limit on either side beyond which it is not profitable to go.

As to the proper plan of feeding, with reference to time, amount of grain, &c., our practical men seem to vary very much, and if a given amount of hay and grain is named, most of us would be in doubt whether to feed rapidly for a short time, or to give smaller amounts and extend the work over a greater space of time, both plans have their friends, and no doubt their advantages as well as their disadvantages. My favorite plan is to buy cattle, in good order, in September or October, and turn them on good pasture, clover and timothy first, and after one or two sharp frosts on the green grass of our meadows, as soon as the grass loses a portion of its nutriment from frost feed a small amount of meal, and sooner or later a little hay or fodder is added, until by the time it is seasonable to shut them up in the yard and stable they have become gradually habituated to the change from green to dry feed and do not suffer from it.

The amount of grain is gradually increased until by New Years they are receiving their full winter allowance, amounting to one quart of corn and oats (ground) to each two hundred pounds of live weight; with occasional changes to cornmeal and bran, or corn ground down on the cob, this is continued until spring. Before the pasture is of sufficient growth to permit them being turned out entirely, they have access to a small lot near the yard, commencing with an hour each day and gradually increasing the time, and dropping on the amount of hay, but keeping up the full supply of meal. After they are turned out in the main field they are still brought in at night and fed meal and a small amount of hay, both then and in the morning before going out again. In a week's time the hay is stopped and we commence to decrease the allowance of meal, but more or less of this is fed for from four to six weeks after they are turned upon grass.

Having a given amount of hay, grain and cattle, the drawbacks to long feeding are cost of labor and interest on capital employed, and I am satisfied that by following the above plan that I can make enough more beef from a given amount of hay and corn to counterbalance these items several times over beside having the advantage of any market between May and September, and the ability to sell at any time between these dates.

As to the proper weight of cattle for winter feeding there seems to be no fixed rule; as a general rule I find that medium sized animals find the most ready sale during the summer months and nett the feeder the best price per pound. For rapid feeding a mature steer of 1,200 pounds will pay best but for the slower process a younger and smaller animal will pay best as you then may have the advantage of some growth as well as increase in fat; cattle of from 1,050 to 1,100 pounds will generally come out of a long feed best. It would seem that cattle feeders, like dairymen, has

each one his own rule for selecting his steers from a drove, and any words of mine on this point would be superfluous.

In order to properly determine the profit of cattle feeding, we must take into consideration the following items: first cost, amount and value of food eaten, cost of attendance, value of manure and value of the animal when sold. We may very safely assert that with an ordinary bullock there is no profit in feeding for the same price per pound as we give, unless we make a fair estimate of the increased value of the manure, and in many seasons unless there is a material raise in the market this item must come in to make the balance on the proper side. If the owner of the land can obtain market value for his grain, he will be warranted in feeding it to well selected cattle for the increased value if the manure will secure him from loss. In either case the gain in weight is a very material as well as very variable item; if I can take a 1,100 bullock in September, and by grass and eight quarts of corn and oats per day, from December to May, with grass until August, and make a gain of 500 pounds, I have done more than an average; the best result I have yet attained in this way in one year was 640 pounds, but this was an exceptional case, and is above the average result of such feeding. I have averaged more per month on large steers with more meal. The winter of 1874–5 seems to have been a good one for the feeder; my record shows that steers costing $4 82 per hundred pounds live weight were sold for $7 75; bought September 5th, and fed as above, they were sold March 5th. Seven head sold on the above date have the following as the debit and credit account:

Dr.

By 56 weeks pasture @ 75 cents	$42 00
By 125 bushels meal @ 75 cents	93 75
50 bushels soft corn @ 25 cents	12 50
	157 25
Cost	408 00
	565 25

Cr.

By 7 head @ $105	$735 00
	565 25
	169 75

Against this sum of $169 75 is to be charged the hay and corn fodder consumed by 7 steers, as well as the labor and attendance; the account should also be credited with value of manure. Of the original number (11) four were retained and fed until they were turned out in grass, on

which they ran until September 23d, or one year and eighteen days from time of purchase, when they were sold for $7 75 per hundred live weight. Their account stands thus :

Dr.

By 75 weeks pasture @ 75 cents	$56	25
By 118 bushels meal @ 75 cents	88	50
By 28 bushels soft corn @ 25 cents	7	00
	151	75
Cost	227	00
	378	75

Cr.

By 6,610 lbs @ 7¾ cents	$512	26
	378	75
	133	51

By obtaining market prices for the grain, the feeder can readily afford to offset the hay and fodder by the manure, and is fortunate if he can do so. In the above case there was a margin for profit over and above these items. The past season being compelled to sell about one-fourth of a cent per pound above cost price, the margin is the other, and it needs close figuring up of the value of the manure to show any profit at all. By feeding as before stated, from September 10 to July 20, there was a margin of only $28 above cost price, but the manure shows its value in the crop of wheat now growing.

On the feeding of 1874–5, the gain in weight from September 8 to March was 2,960 pounds, or 270 pounds per head. This is at the average rate of 1.52 pounds per day, and after running over my record where a separate account has in many instances been kept with each animal, I find that a daily gain of 1.5 pounds has been above the average, while for short periods of time it has been much exceeded. Taking the average of different lots of cattle, and the average of winters the feeder who can put on an average of one and one-third pounds per day, or 486 pounds in one year's feed does well. Many fail to add 350 pounds to the live weight, but this is usually due to bad selection, want of care in feeding, or some other cause for which the business is not in any way responsible. Taking the average of a large number of cases which I have on record as the experience of other feeders, I am inclined to think that from one and one-quarter to one and one-third pounds per day represents the gain or live weight. Feeding eight quarts of meal per day at the above prices would cost eighteen and one-half cents per day.

ADDRESS READ BEFORE THE AMERICAN FORESTRY ASSOCIATION.

BY BURNETT LANDRETH.

The modern and doubtless correct idea of the road to perfection is by division and sub-division of labor, study and investigation; hence we see lawyers devoting their professional attention to jurisprudence as applied to commerce, others to land titles, even to criminal practices, as it is called, in which latter it is sometimes difficult to determine which is the greater criminal, the culprit at the bar or the professional who defends him. In medicine, some apply themselves to surgery; with others, all their powers of investigation are devoted to the eye, or ear, or clinics; and we naturally call to our aid, when necessity requires, those who have achieved a reputation in the special department which suits our case. In agriculture, the reverse seems to be the popular rule, and mixed, rather than specific farming, is generally advocated—probably the presumption is that, whilst preparatory study and practice are requisite to form an accomplished member of a "liberal" profession, more are farmers intuitively, and knowledge, whether of soil with its chemical constituents, of cereals, of cattle, sheep or swine, may be sufficiently understood without study or previous acquaintance. Never was a greater mistake, and the farmer who should uninstructed step behind the counter of a Stewart and direct the movements, would soon find his error, just as so many citizens have in the reverse case tested to their cost that there is no royal road to technical knowledge. It is not my purpose, however, to dwell on this phase of rural life—there is not one whom I address who does not realize the necessity of training preparatory to successful husbandry.

What I desire now in an especial manner to direct attention to is, a branch of agriculture which, until recently, has been almost entirely overlooked by us. I of course refer to Forestry. Heretofore the way to get rid of timber at the least outlay of labor, possible, seems in many cases to have been the object aimed at, and we have gone on in that insane effort until now, whilst we are yet in our infancy as a nation, our country is naked, and the sources of supply of valuable timber, either for ship-building, mechanic arts or fencing, are so remote that had it not been for permanent extension of railroads penetrating the utmost resources of the forests, prices would have advanced beyond any reasonable measures of values, and have seriously impeded the construction art.

If we turn our eyes northward from whence the valuable white pine lumber is exclusively obtained, we find that many thousand acres which only a few years ago, comparatively, were covered with a dense growth of this invaluable timber, have been cut off; and they who cater for the timber market have receded almost out of sight, ere they could find further supplies. Maine, once by way of distinction termed the White Pine State, is now denuded, and mills erected for manufacturing pine lumber are content to grow spruce logs less than a foot in diameter; and to-day were it not for the paralysis which has seized on industry, the price of white pine would be at least several times greater than ever within the memory of those whom I now address.

The same condition of affairs applies to hemlock, one of our valuable American trees, which, like the buffalo, is recklessly slaughtered for its hide; until shortly it must cease to exist upon our continent, unless the practice of this generation be radically changed. How sad to know that the noble hemlock is thus ruthlessly cut down for the simple bark which encases it—itself many times left to lie and rot, as a monument, perishable fortunately, of the profligacy of man who to supply a present want recklessly destroys that which should be the invaluable heritage of his children.

Now, where is the evil to stop? Legislatures cannot be invoked to correct the evil. A man has a right to do in these particulars as his ideas of private interests prompts; and unless by moral suasion, and the argument be sucessfully enforced that he is killing his own goose which is laying golden eggs, the error will doubtless go on to the bitter end, until every primitive tree within the reach of market has been laid low, disregarding the fact that the annual increase in cubic contents and the certainty of enhanced prices present the best investment the present money values could be placed in. Fortunately those of us who reside upon the seaboard have a recourse not likely to fail, and the more especially not likely in view of the large areas of once tilled land, now being re-clothed by forests. I refer to the Southern pine, of which there are several species, each of value in the departments of the coarser arts.

Those who less than a century ago traversed our seaboard, beginning at Portsmouth, Virginia, and extending their route through the Carolinas, Georgia and onward could not fail, it is said to be forcibly impressed by the apparently interminable forests of this valuable timber; stately trees in absolutely countless numbers; each representing a value which to a northern eye could be as surely estimated as the sheep on the hill side, or the cattle on the broad prairies.

Alas! in most cases the denseness of these road side forests have disappeared and he who now makes the journey to which I have referred, will find on tens of thousands of broad acres, only the blackened and charred

stumps of those once stately trees—the needs of the passing hour have compelled the imprudent owners to convert them into ready money. We have only, however, to advance onward and westward of the coast line a few miles to find ample store of similar timber, which lateral railroads are procuring, paving the way as it were towards the markets of the great cities. Happily to restore the exhaustion of yearly demands, acres on acres of corn and cotton fields, worn out by reckless tillage and abandoned by the plow are being reclothed by nature to be sources of supply of yellow pine timber of immediately succeeding and future generations. *For this special variety nature is thus making ample provision.* So readily does it, (the yellow pine) make itself at home in light, sandy soil, that within the memory of man, the lower county of Delaware, and the peninsula bounded by the Chesapeake and Delaware bays, has been made the favorite locality of the common yellow pine, which has attained sufficient dimensions within the period referred to, to be cut for saw logs—and this is a district of country where previously pine was absolutely unknown; the forests being exclusively of hard wooded trees. But we need other than yellow pine lumber; good as it is, it does not supply every want, and unless the science and practice of forestry be taught, those wants are destined to go unsupplied. It is to this special point I desire to invite attention, and in connection with it, and the subject of white pine in its northern latitude, I would here relate a fact which may, I feel confident is, destined to exert an important influence on the future sources of supply; indeed I do not hesitate to predict, may prove the starting point to fabulous extent, in the light of which cotton itself, as a product exclusive to the South, may lose somewhat of its lustre. A gentleman of Virginia, a friend of mine, largely interested in lands, a shipper of timber from the seaboard, therefore not inexperienced, discovered in his forest explorations that for the want of a better term, I shall call *a white pine settlement*, in the dense yellow pine forest of the northern neck of the State. In the midst of a group of white pines extending over an area of five or six acres, stood a gigantic individual tree, ninety-six feet high, eight feet in circumference three feet from the ground. There it stood and stands to-day surrounded by seedlings from forty feet high down to seedlings of a year old, as the boundaries of the settlement are reached, numbering in the whole, three or four thousand.

There is a fact which cannot be questioned. It is like the testimony of the rocks. A bird of passage had evidently dropped a solitary seed at some period long preceding, which springing up had established itself in its new home, far distant from the region where nature had placed its ancestors. The mere fact itself of a white pine having fixed its abode and prospered in a remote locality, is but a trifle—a circumstance of but little

practical significance, but taken in connection with inferences not to be ignored, its value can hardly be over-estimated. The proof is made patent that this tree of northern habits, thrives equally well with the southern pine (of which there are several species commercially classed as Carolina) in the latter's native sand, and under the scorching sun of the south, opens a vista in forest tree planting which those who look beneath the surface, cannot fail to appreciate. *It is the index to future wealth of inconceivable magnitude.*

In the science of forestry, trees are divided into two distinct classes—one called *encroaching*, which perpetuate and increase themselves under favorable conditions; the other *receding*, which disappears before the advance of civilization. To the former of these white, like the yellow pine, evidently belongs a very important circumstance in connection with its proposed culture.

Already I have the satisfaction to announce, and desire the fact be placed on record, that my firm which is interested in forestry has embarked in the planting of the white pine on the seaboard of Virginia, and though the time is too short to state the actual success of such plantations, there is every reason to expect good results. If the question be asked why plant white pine when yellow pine spring up indigenously, spontaneously on every abandoned acre found in that region? The answer is simply because there is no present possibility of a short supply of the yellow, and the white is under all conditions worth double the money in the market, and produced on the seaboard, can be transported by water at immeasurably less cost than from the far north; beside the land without undergrowth there, ready for planting, can be purchased at smaller cost; and it affords a prospect of recuperation for that section which no other industry presents. In a patriotic aspect, it is, therefore, worthy of attention. Tens of thousands of acres, hundreds of square miles of worn out corn and cotton lands lie contiguous to the sea, whilst their owners stand with folded arms waiting for something to turn up. These lands wont pay for tillage in grain, and grass for pasturage is not enduring. To buy fertilizers is out of the question, and it is cheaper to emigrate to the rich bottom of the Mississippi, where cotton is the desired staple.

Whilst the broad prairies of the west and the natural grass fields beyond the Missouri and on the Pacific coast invite the emigrant from abroad, and the native seeking a new home, the south is likely to be overlooked. What then is to be done? Re-clothe the abandoned or at least neglected lands with forests as in the days of the early English settlers, and the whole scene will have changed; prosperity will once more visit that region and with accrued capital, better system of tillage and free schools established at every cross roads, sectional difference will disappear and we shall henceforth be

a united people. In Europe, forest culture—the planting of forests for timber—as all present know has been long successfully pursued; and the practical processes are taught, I believe, in the agricultural schools. Long ago, however, ere such colleges were established, no inconsiderate progress had been made in that direction by owners of large estates, notably in Scotland when land planting was introduced in 1738, by the Duke of Athol, and so successfully prosecuted as to be familiar to you all. In Germany and France similar progress has been made, artificially formed forests being met with on every hand, the developed pines, spruces and firs planted at uniform distances, and possessing symmetry of growth, the branches interlaced overhead, reminding one of the pillars of some stately cathedral. Now, what I desire on the present occasion is, simply to drop a few hints which may induce reflection. I arrive only at so much, not to instruct, for I am myself only a student. If anything which I may say shall be found to bear fruit hereafter, I shall be compensated. Among other things I wish to start the inquiry, whether in our classification of agricultural instruction the time has not come to teach *forestry* as a science—I say science, because it is susceptible of exact results; whether in the sub-division of rural interests the practice of tree planting should not be clearly recognized among the present and prospective industries of the people. Of course, it is not to be supposed that all localities are farmable, all alike promising profit. The manufacturer when he determines to locate his works seeks the point either where a ready market may be found, where raw material is readily obtained, or where fuel for steam power or water power is at command —some one or more of these conditions was indispensable to success. So he who plants forests must use proper discrimination or he will find either the accumulated interest on the land, or the cost of reaching the market for his lumber, may eat up the natural accretion or a generation's growth. So also the planter must study the adaptation of special trees to his soil, exposure to climatic changes, time which he can afford to await returns and other circumstances incident to the enterprise. He must study, and carefully study, too, the methods of procedure; the gathering of the seed and its preservation until sown, the proper time and method of sowing, whether it be in seedbeds under sun screens, the young plants to be subsequently transplanted into nurseries preparatory to being permanently planted out, or as in the case of oaks, walnuts, chestnuts, and trees of a smaller character, the seed be planted in the field or mountain side to remain undisturbed. In all these processes there is so much skill requisite, technical skill only attainable by practice and observation, that it will at once occur to the reflectory farmer or cotton planter that he is probably unprepared to embark in the enterprise. Having been convinced of that fact he has already taken the first step towards success; the next will be.

SOUTHDOWN RAM

The Property of James Mills Esq.

if he decides to plant, to employ the service of an *expert*—a class of men in this branch of industry not readily obtainable in this country. What then is to be done? Do not start till he is ready to send his son to an agricultural school, where he may be taught the whole a b c to z, the alpha and omega of forestry. Whilst studying *that* he will acquire knowledge of natural science and other information invaluable in rural life. I am aware that agricultural schools under the patronage of State governments have not been uniformly successful; indeed it is only candid to admit that they have in some cases, that of our own State of Pennsylvania included, been sad failures; but should we not profit by our experience in these particulars and henceforth, like a skillful mariner, avoid the shoals? There are however opportunities extant for instruction and it is our province to provide others without delay; failing such, under special circumstances, the entering a youth for a term as a pupil of a well conducted nursery may accomplish all that is contemplated. In such an establishment he could in two years be initiated into the art and mystery of rearing trees from the seed, the processes of culture, the care, preservation and transplanting; and if he were of an investigating, inquiring mind, he would acquire visions of nature which have never entered into the view of multitudes who take rank as successful farmers.

In England it has long been the practice of the commercial and manufacturing classes in search of greater security for their acquisition than trade presented, and, perhaps also in some cases to take rank as country gentlemen, to place sons of well educated, accomplished farmers, to be instructed in the practical details of husbandry preparatory to taking charge of landed estates in their new interests. May not that plan point out a method of teaching forestry; where competent men may give instruction in that especial branch as well as in other pursuits of rural life—schools under the refining influence of home?

In days gone by forever it was the practice of southern planters to send one of their sons to the Medical School at the Pennsylvania University or Jefferson College. Here they passed two winters in attendance on the lectures, returning home with diplomas in their pockets, not in most cases to practice medicine as a profession, but prepared to minister to the wants of the plantation hands and household servants. It might be difficult to estimate the influence on the intellectual character of an isolated rural community, when one of the young men found his abode, imperfect as his education may have been, compared with the great field of knowledge unexplored. Now, in becoming farmers, with the necessary means to send their sons as students to nurserymen, it is not with any expectation they adopt the nursery business as the pursuit of life, but simply to qualify them for the more profitable enjoyment of their paternal acres, to expand

their views beyond the boundaries of the homestead, to occupy the high position which is an American farmer's birthright.

I trust this convention may be the forerunner of others, that a complete organization will be established, that subjects for essays to be read at subsequent meetings may be determined upon in advance, and that its influence be extended at home, and conference be had with kindred associations abroad.

I beg leave to lay upon the table of your chairman my credentials as a member of the Scottish Agricultural Society, and that Society's representative at the Centennial Exposition.

IRREGULAR NOTES ON REGULAR TOPICS.

BY A PRACTICAL FARMER.

In the every day life of a practical farmer, whose mind is reasonably active, there are always leisure moments during which he will employ the time with the many questions which crowd upon him during the day; of these periods we may instance that the time spent in waiting for his own meals, waiting for the teams to furnish their grain, churning for the good wife, and similar periods too numerous to mention, to such are due the following stray items, which, however irregularly noticed, will, we think, always be found regular in their nature, and they are offered to the reader not so much for what they may actually contain as for the thoughts which such items must always suggest, believing that we may often learn more from a clear expression of opinions with which we cannot agree than from those which correspond with our own—the former arouse an investigation into our reasons for differing with the writer while the latter do not, and after having been read, leave but little of a lasting impression. No doubt many will find opinions expressed which they deem far from orthodox, but let it be remembered that they are only the opinions and thoughts of the moment and not the result of mature deliberation and preparation, but are written off hand as they occur. If in their course the reader finds any two to clash or even to be in opposition with each other, he must not necessarily think that any radical change has taken place in the writer's opinion, but rather that by pursuing a different train of thought he has arrived at different conclusions. If any allusion is made to anybody's patent, either in the form of implements or manure, the writer wishes it distinctly understood that he has no interest in anything of this kind further than is to be found in his use and application of them on the farm, and if in this way any one's corns are trodden on it is without any personal animosity to injure. Of those who agree with the ideas and opinions advanced he has no favors to ask—from those who differ from the views expressed he only asks that they will establish in their own minds the *reasons* which cause this difference and his object so far as they are concerned will have been fully attained.

VALUATION OF MANURES BY ANALYSIS.

Artificial fertilizers are mainly valuable in proportion as they contain the four following elements: potash, phosphoric and nitrogen. Now these

have a fixed market value, and by finding the actual amount of each in a manner and multiplying it by the value we ought to obtain the commercial value of the manure. The phosphoric acid may be divided into that which is taken up by cold water; insoluble phosphoric acid is of course that which is not so taken up, and hence is not so valuable. In the analysis of a manure we take into account the following items: moisture, drawn off by drying at a gentle heat; organic and volatile matter, separated by a higher degree of heat which either drives off or destroys this class of matter; sand and insoluble matter left after all soluble portions have been taken out; soluble and insoluble phosphoric acid; bone phosphoric lime equivalent to phosphoric acid; nitrogen and ammonia equivalent to nitrogen.

The potash is valued at 4 cents per pound; the insoluble phosphoric acid, at 4½ cents; the soluble phosphoric acid at 12½ cents, and the nitrogen, at 17 cents The value of the bone phosphate of lime is obtained by multiplying the total phosphoric acid by 13 and dividing the product by 6. Taking the above as a guide, let us note the effect upon the value of some of the *more common* brands of commercial fertilizers, which I will give by numbers.

An analysis of No. 3, showed:—

Moisture	16.99
Organic and volatile matter	19.75
Sand and insoluble matter	1.67
Soluble phosphoric acid	3.19
Insoluble " "	16.16
Total " "	19.35
Phosphate of iron and alumina	1.39
Bone phosphate of lime, equivalent to phosphoric acid	41.90
Nitrogen	2.00
Ammonia, equivalent to nitrogen	2.43

This is a phosphate well known in the Philadelphia market, and when the analysis was made was selling for $65 00, but is now lower. Applying our test to this analysis we learn the following value of ingredients:—

Soluble phosphoric acid	$7 98
Insoluble " "	14 54
Nitrogen	6 80

Making a total of $29 32, as its value for these elements upon which nearly all of its manurial value depends.

Taking one of the higher grades of Pouderette, then selling for $28 00 per ton, an analysis shows it to be composed of—

Moisture	3.40
Organic and volatile matter	25.41

Sand and insoluble matter	53.43
Soluble phosphoric acid	None.
Insoluble phosphoric acid	2.32
Phosphate of iron, &c	None.
Bone phosphate of lime, equivalent to phosphoric acid	5.03
Nitrogen	.10
Ammonia, equivalent to nitrogen	.13

Taking only the valuable elements, we have in value

Phosphoric acid	$2 09
Nitrogen	34

Giving us its total value to the farmer as $2 43 per ton, or $25 57.

When I apply the rule to the analysis of nine grades of manure now in my possession, I find that the nearest approach to giving the farmer full value is in a phosphate selling for $60 per ton, and showing a value of $47 32. The worst of the nine seems to be a phosphate which at the time of the analysis sold for $60, and by this gauge was worth exactly $2 33 per ton, or $57 67 less than cost. Taking the value of 16 kinds which have been analyzed, I find the actual value of one ton of each of the sixteen to have been $341 33, while their cost would have been $812. A number of these manures are sold to the farmers of our State every year, and the amount which is in this manner taken out of the farmer's pocket would surprise all.

DOES FARMING PAY?

I believe that all hands have conceded that farmers have some kind of hereditary right to growl and complain; one year is too wet, another too dry; one season an early frost, and next a late one is the cause of our trouble, but with all this growling, (which may only be a habit,) it would seem that farming paid. In casting up our accounts and striking our balances at the end of our financial year, we too often neglect an important item—the board of our families and the little home comforts which the farm produces.

Nearly all the old city merchants with whom I am acquainted, agree that no new business or trade in the city will average more than from three to four per cent. profit upon *all* the capital invested. It is true that some do better than this, but others fail to pay their debts. Some railroads pay good dividends, while other stockholders lose both interest and principal. Where one man makes a fortune in mercantile line, nine will fail to make any more than a living, and probably five of the nine will fall short of even this. In view of these and other facts, I am willing to place four per cent. as the average of capital in business other than farming. Now let

us examine the other side of the question. A man who owns a $10,000 farm clear, and stocked to the amount of $2,000 more, can work when he feels like it, visit a neighbor or friend when it suits him, leave his business for a few days, and suffer no loss beyond that of his own labor. On this capital of $12,000, he will keep his family comfortably, and save something each year for a rainy day. The interest on this sum is $720; can he move to town and keep his family on this? or can he move into a country village (where living expenses are low,) and keep his family one year on this amount? or to put it in another light, do we not often see men who rent a farm for four per cent. stock it, and after keeping their families comfortably, make more or less every year? A certain class of orators at grange and farm club meetings would have us to believe that the farmer is one of the most oppressed and poorest paid of all men, but such appeals generally show a cat in the meal bag, in the form of "send me to the Legislature and all will be right." There are natural laws over which we, fortunately, have no control, which work to keep the balance about even among the various trades and callings. Competition is free and open to all. If one trade or occupation is unusually profitable, others soon find it out and the extra profit is soon cut down to the established rate.

At the present time the speakers formerly allowed to make what they considered to be a showy point in establishing the poor remuneration yielded by farming in the immensely long list of sheriffs' sales of farms as shown in our county papers. If we will carefully investigate these cases, we will find that by far the largest proportion of these are those in which parties bought land at the high prices which prevailed during the war and going in debt to the amount of one-half, (or even more in some cases) they find that the shrinkage in value comes off *their* half and not off the mortgages. In conclusion, in what way can a man of reasonable wishes invest ten or twelve thousand dollars in which he can be more independent and live more comfortably than in a good farm? But some may say, suppose he has not that amount to invest. Then he is but parallel to the case of the merchant who has less—he must work harder and expect less profit. If he has five thousand dollars it will puzzle him to make a living in any way without a good amount of work.

DEEP CULTURE.

Deep and thorough tillage prevents or at least mitigates the bad effect of long continued dry weather in two ways. More or less moisture always exists in the subsoil—a loose porous soil acts like a sponge in drawing this moisture towards the surface, but a hard, compact one not only prevents the free action of capillary attraction but also increases the evil by acting as a good conductor of heat. To illustrate this point—a fire kindled on a

large block of stone will soon heat the whole mass, raising the temperature highest at the point of contact but more or less affecting the whole; if this solid stone is broken up into a fine powder an equal increment of heat will effect it to but a small depth below the surface, while the bulk of the mass will remain unaffected. Even the dryest air (in a natural state) contains more or less moisture; a well pulverized soil will attract or absorb this moisture, while a compact or hard one will fail to do so. To prove this, dig a hole to the depth of fourteen or fifteen inches in the bed of the hardest and driest public road which you can find; thoroughly pulverize the earth taken out and then return it to the hole; in forty-eight hours the finely divided soil will be moist while the generally dry soil will be still as dry as before.

A well cultivated and thoroughly divided soil not only permits the easy passage of roots but also encourages the passage of rain downward whereby fertilizing elements are taken directly to the roots of the growing crops, while a compact or solid soil will shed the water like a roof.

We may then assume in favor of thorough tillage and cultivation that it prevents the loss of moisture from the subsoil, and at the same time absorbs it from the air, that it promotes the growth of crops by affording easy access of the roots, and by a supply of available food when it is most needed. In view of these and other facts which might be offered, it is not possible that it would pay us to cultivate our corn and other hoed crops much later in the season than most of us are in the habit of doing.

THE ACTION OF LIME.

Many of our farmers seem to have a wrong impression over the manure in which lime acts, for many still claim it as a manure. It is true, that to a very limited extent, it does act as a manure, for all of our crops contain more or less lime, but even the poorest soil usual contains enough to supply all the wants of the crops for hundreds of years if other needed elements are all provided. Admitting this, we may claim for lime three modes of action, viz: Mechanical in stuffing loose soils; chemical in changing compounds with which it comes in contact in the soil, and manurial so far as it enters into the composition of the crop.

If the product of a twenty-five bushel crop of wheat, (grain and straw) was all removed from the field and none of it ever returned again the soil would lose less than ten pounds of lime per acre, no allowance being made for what is used in its chemical action, hence we see that this claim of manurial value is of but little account. For the mechanical action we can claim but little, and that little only in special cases which occur so seldom as to hardly enter into or affect the question. It is evident then that its main and most beneficial results depend upon its chemical action.

All soils which grow mosses cinque-foil show upon their surface the clear indications of too much acid, and without a true understanding of the term we call them "sour." Lime when applied to such soil forms combinations with these acids, and from their not only useless but deleterious state changes them into at least harmless but often valuable compounds.

It is very often the case that there exists in our soil substances of themselves valuable, but existing only in connection with acids which make them valueless if not hurtful. Lime coming in contact with such substances will often rob the base of its acid and of the three or four form two new and often valuable compounds, or failing in this will neutralize the bad results arising from the presence of the original compound.

Air slaked lime is a hydrate, and contains of lime 76 parts, and of water 24 parts. In this state it was the greatest power to produce chemical changes, and this is the condition in which it should always be applied to land. If the operator is allowed to go beyond the air slaked point, a carbonate of lime is formed, and after the absorption of carbonic acid once begins the lime heap is losing in value every day. Lime which has been thoroughly and perfectly slaked with water consists of carbonate of lime 57 parts, lime in the form of a hydrate 33 parts, and of water 10 parts; or one ton of lime left exposed to the air and rain until it is *all* thoroughly slaked, contains only eight hundred and fifty pounds of hydrate or air slaked lime. Lime is often accompanied with magnesia, and in such cases is always much more caustic in its effects, and when the magnesia exists, (as it does in some quarries,) to the extent of from thirty to forty per cent., its applications in large amounts often produces unprofitable results. It is seldom that limestone entirely free from magnesia is to be found, but if a load of the purest and a load of that rich in magnesia are shot out side by side, and allowed to remain for a proper time the latter will effectually kill the grass under and around it, while the former will root, and in the after culture of the field it will be several years before a good crop of even grass will be produced where the magnesia lime laid. Both chemistry and practice show that lime produces its best and greatest effect when applied in the form of a hydrate or in the air slaked state, and it will pay to protect the heap from the rain until it all takes this form. If under a good roof it may remain for three or four months, and will spread much better than if exposed to the rain for only one month.

THE CARE OF BARNYARD MANURE.

Many practical men are disposed to smile when anything is said about the proper care in the formation of yard manure, and yet many fail to receive the full benefit of it for the want of a little labor and care at the proper time. Horse manure being of a volatile nature, and usually con-

tains a large amount of straw, will "firefang" and heat if thrown in a pile by itself; this heating involves a heavy loss of nitrogen in the form of ammonia, and may be prevented in two ways: the manure when taken from the stables may be placed in front of the stable doors or around the water trough, where it will be thoroughly packed down by the feet of the stock; or better still, it may be mixed in alternate layers with the manure from the corn cutter stalls; the latter being less heating and volatile in its nature seems to counterbalance the bad habits of the horse manure, and the result is to the benefit of the owner. In the absence of any other manure with which to mix it, and of stock to tramp it solid, the next best plan is to try salt and plaster (gypsum) occasionally, and when any underheat is observed, apply water liberally, but not so as to run off and waste the soluble portions of the manure. In the same manner the manure from the sheep sheds may not only be much improved by diluting, but also by preventing loss by heating, and while it loses little or nothing, the other manure gains. When much long straw or fodder is thrown into the yard, a bushel of plaster (gypsum) sown each week will have the effect to insure a more thorough division, save less of ammonia and add value to the pile.

When the manure is not to be hauled out for spring or *early* summer crops it will pay to throw it up into piles, under shelter if possible, but if not, at least into conical or roof-shaped piles finishing off with a heavy dash of plaster; a little long fodder or straw will prevent loss from the effects of the sun, and the labor of keeping will not only be amply repaid by the increased ease of loading, but also by the more finely divided condition of the manure. It is too often the case that we imagine that we are adding much to the value of our manure piles by passing a large mass of straw or coarse fodder through the yard. After enough is provided to absorb and prevent the loss of all moisture it is very doubtful if more straw and fodder produces any better effect than if hauled direct to the field. Unless it can absorb the liquid portions of the manure there is not any very great manurial value in either straw or corn fodder, and their action depends in a great measure upon the mechanical effect in loosening the soil and permitting the entrance of air and moisture—their actual manurial value is very slight in proportion to the bulk.

MIXED FEED.

It still seems to be an undecided question as to whether it pays to mix meal with cut hay or other coarse provender. The theory is that by so mixing we compel the animal to re-masticate the meal before digestion begins. No doubt all coarse food goes into the paunch, or as it is called, the first stomach and that meal and all sufficiently fine food passes into the fourth or true digesting stomach of ruminants. The theory of thus

mixing the food seems to stand or fall upon the action of the second or smallest stomach. It has been claimed by some who are very properly regarded as authority that the office of this organ is to separate the course food from the fine, and after formed into balls, to return it to the mouth for re-mastication, while the more finely divided portions are passed directly into the fourth or true stomach for final digestion. If this view is correct (and there is nothing to prove that it is not) all that can be gained by the mixing of meal with cut hay is the extra moistening which it receives in its passage through the first and second stomachs. If, however, the second stomach (as some claim) does not make any separation, but only forms the contents of the first stomach into balls suitable for passage into the mouth to be again worked over, then much may be gained in the re-mastication of the meal by mixing. Without being able to settle the disputed question of the action of the second stomach I am satisfied from more than the trial that from some cause it will be found profitable to feed at least a portion of cut hay or fodder with the meal; whether this effect is due to any increased action of the first or second stomachs or whether it is due to the fact that the meal is more thoroughly moistened with saliva I am not prepared to say, and only state what I believe to be a fact. Let the united action of the various stomachs be what they may, it would seem that the second one has some power to extract and hold any improper material which may enter it, for in it are found all the nails, stones, &c., which we from time to time hear of being removed from animals slaughtered for beef.

The difficulty which must always attend such experiments prevents me from being able to state exactly how much the gain or weight may be increased by feeding the meal in this way. I have found it to vary very much in different animals, and at different times, but in all cases there has been more or less gain in favor of the plan which at best costs but little.

WHEN TO APPLY LIME.

In applying lime to the soil there are three axioms which must be kept in mind or loss will ensue.

1st. That it will liberate ammonia from partially decomposed manure. Nitrogen or ammonia is held in combination with other substances for which lime has a more powerful affinity, and asserting its powers it robs the ammonia and sets the more valuable parts free, and being volatile they are lost unless some absorbent is presented.

2d. That it takes some time for lime to produce its effect. This length of time will depend upon the kind of lime and the manner and form in which it is applied. From some quarries an application in the spring will materially help the crop of corn, and from others it requires nearly or quite a

year before its effects are shown. If applied in a caustic or hydrate state its effects are much sooner visible, and if it could be ground and applied hot from the kiln its effects would be still more immediate. In either case the general result would probably be the same, the more rapid ones soon exhausting themselves.

3d. That caustic lime hastens the decomposition of organic or vegetable matter, and if this decomposition has partially ceased, lime will arouse it into further action.

To those who apply lime to the fences and buildings for the purpose of preservation, the first portion of the latter axiom may seem a contradiction. Lime mixed with dry vegetable or organic matter without the presence of moisture and soil, or even with moisture and without earthy matter, will preserve it until mixed with the same or similar matter, in the presence of earthy material it will assist in and hasten its decomposition.

From a consideration of these axioms it would seem that lime should be applied to the soil when it contains its largest amount of decaying vegetable matter. That it should not be applied in connection with yard manure or manures having much nitrogen in their composition. And that it should be applied some time before its action is desired. After going over the whole ground it would seem that each and all of these axioms could be best carried out by applying the lime to the soil the fall before it is plowed for corn, at this time the soil contains its largest amount of vegetable matter, (sod,) and the lime will have time to act before the corn crop needs it. Failing in an application at this time, the points desired can be best attained by making the application in the fall after the crop of wheat has been removed.

When we remember that the main benefit of lime is due to its action on inert vegetable matter, it is easy to see that the farmer who applies lime liberally without a correspondingly liberal application of vegetable or organic matter in the form of manure, is drawing upon his principal instead of being satisfied with the interest, and if persevered in must eventually end in impoverishing his soil. From this effect the old adage to the effect that "lime enriches the fathers but impoverishes the sons," obtains its full force. If the fathers apply lime without a corresponding application of manure, the supply of organic matter will be decreased and the sons must lose by it.

FENCES AND FENCE LAWS.

Judging from the discussions of our farm clubs we may suppose that farmers are beginning to realize that the true office of outside fences, and in fact of all fences, is not to keep out the stock of a neighbor but to restrain our own; as a result of this idea we see laws preventing stock of any kind from running at large in the highways, are gaining in form and

the area over which they extend is every year increasing. It is a mistake to suppose as many do that the fruit and grass growing between the fences of a public highway, of right belong to the public; the public have only the right of passage over the ground, but have no right to its products which belong to the owner of the adjoining farm. As soon as the traveller or the stock of the farm diverge on either side of the legal limits of the road, they become trespassers in the full extent of the term. In strict equity it is no excuse that there was no fence, for, as before stated, fences are to keep the proprietor's stock within bounds and not to keep others out. It takes a long time for us to get rid of the idea that a "legal fence" must be "horse high, bull proof and hog tight." Sooner or later we will arrive at a point where every farmer will judge of the quality of his own fences, or in fact whether he will fence at all. Much has been said of the injustice and "cruelty" of a law which prevents the poor man from turning his cow in the road. In the first place it is poor economy for any one to turn a cow on the public road, the time spent in hunting her when she fails to come home and the loss of milk from not being milked at the proper time will usually pay her keep in much better pasture. Of all fence breakers the road cow is positively by far the most efficient and active, and independent of her own efforts her presence leads the farm stock, otherwise quiet enough, to break out and cause trouble. When cows were allowed to run at large on the roads it was impossible to keep a bull more than two or three years for he became so unruly as to be a nuisance to his owner; in the laws excluding stock from the roads this trouble is avoided.

Those who have never given the matter careful attention will be surprised at the cost and extent of fencing in our State; the most reliable data obtainable show that we have 16,374,641 acres enclosed by 156,377,821 rods of fence at a cost of $179,834,494, and that the average cost of annual repairs, is $6 32 to each one hundred rods, or a total of $9,883,073.

In his report for 1871, Mr. Dodge, the able statistician of the Government Agricultural Department, by a series of reports from agents in each county, was able to estimate the total cost of our fences at $1,700,000,000, and the cost of the annual repairs, at $198,000,000. From this data he states that the national debt, the value of our live stock, and the cost of our fences all three be represented by the same figures.

There are many ways by which a portion of this expense may be avoided. Of course the position of the water supply has much to do with the division of our farm fields, but there can be no doubt that for the want of a more systematic system we use much needless fence. Of all other forms that of a circle will enclose the greatest area with the least fence; this form being impracticable, we find the next best to be that of a square; as soon as we deviate from a square to an oblong form, we increase the amount of

fence required to enclose a given area. A square of ten acres may be enclosed by 880 yards of fence; the same area, if twice as long as wide, will require 960 yards. As the length in proportion to the breath increases, the loss in fencing increases on a similar ratio.

ARE WE PROGRESSING?

Have farmers made any progress during the last twenty-five years, or are they like the lost traveler passing around in a circle until having found his own track again encourages himself with the idea that by following the track he can reach a habitation, until finding another and still another track, he finds he has been traveling in a circle around which he has passed four times? For many years it was thought to be one of the "established facts of dairy practice that milk when set away to raise cream should not be more than four inches in depth, and that any increase in depth was always accomplished by a corresponding decrease in the amount of butter. *Now* we find that it may be set in cans twenty inches deep and eight inches in diameter, and that if properly managed it will as often make more butter as less, thus proving that the plan will at least make as much butter as the old shallow pans. It was also thought that a temperature less than sixty degrees would retard if not prevent the proper separation of the cream. Now it is clearly proven that at a temperature of forty degrees as much if not more butter of a better quality may be obtained. For a long series of years scientific men have ridiculed the idea that the barberry could have any effect in blighting wheat. Old fogyish and practical men had insisted that where barberry bushes were growing in the fence rows that strips of wheat were blighted in such a form or way as to lead to the belief that the bushes were in some way responsible for it. Now our best authorities on microscopic lore have decided that blight in wheat is caused by the growth of a very minute fungus, which can only be propagated from spires of its own kind, and that the fungoid growth found on the barberry bushes are identical with that on the blighted wheat, and further that it is not unreasonable to suppose that by the action of the wind the spires of this fungoid growth may be blown into the heads of wheat, and thus propagate the disease in fan-like strips proceeding from the barberry bushes. Much time and ink has been used to prove that drilling would produce the best crops of wheat, and yet the results of experiments at our Eastern Experimental farm seems to prove that when the preparation of the soil is the same in both cases, broad casting and harrowing we will produce the best crop of both grain and straw.

In the line of improvements in live stock we are certainly progressing; the Alderney cow of to-day is a great improvement on the cows of fifty

years ago and the grade Durham steer of the present will make nearly one-half more beef than the native of fifty years ago.

The use of commercial manures has rapidly increased and still continues to do so and, by careful analysis, the farmer may more effectually guard against imposition in this line.

If there is one particular department of agriculture which has not kept up with the progress of the times it is the hired labor employed on the farm; this is scarcely more intelligent or at least any more efficient than formerly. It would seem that one of the most readily adopted remedies is to erect one or more small houses on each farm in which the farm hands can live and *board themselves*, thus relieve our already too heavily tasked wives and daughters. It is claimed by some that a farmer can board his men cheaper than they can board themselves, but this is not proven; but even if it should cost a trifle more this will be more than compensated by the decreased wear and tear of the female members of the families, who at least are not able to go through what their grand-mothers did. Our farm clubs and other similar organizations are a step forward in the direction of increased sociability which is the great need of the farming community.

FORESTS AND RAINFALL.

The theory that the destruction of our forests invariably is accompanied by a decrease in the annual rainfall, has been so generally received and promulgated that any doubts of its accuracy are almost regarded as rank heresy and yet there are reasons for doubting its correctness. No doubt forests have an effect in more evenly distributing the rain fall, but records in this country are not prolific in proof of any decrease in the *annual* rainfall. Many of the facts which have been brought forward to prove this effect of a decrease, do not bear a careful investigation. It cannot be denied that the rainfall of Nebraska is on the increase, but this cannot be due to the planting of trees. Samuel Aughey, Professor of Botany in the University of Nebraska, in answer to a direct query, writes: "Ten years ago when I first explored the prairies of Nebraska, I found many old bottoms near the headwaters of the larger stream beds entirely grown over with a thick sod of grass and weeds, where the waters had not flowed for ages. During the last few years most of those old streams have commenced to flow. In addition to this, all along the Missouri, on the Nebraska side, and along the bluffs of the larger rivers of the State springs of water have been breaking out where they were never known before. It is possible that the rainfall has not increased much, if any, but the average amount of moisture in the atmosphere undoubtedly has, thus preventing the excessive evaporation to which the surface has been subjected."

As a proof of the correctness of the theory of increase of rain fall from an increase the annual raising of the surface level of Salt Lake has been given, and the result has been attributed to the planting of trees by the Mormons. Careful inquiry during a recent visit there showed me that for each tree planted at least ten had been destroyed, and that the increased rain fall which caused the rise of the level of the lake must be attributed to some other cause than that of increased timber. No doubt as has been claimed for other sections the crops of grass and grain raised by the Mormons have prevented the excessive evaporation which formerly took place from the bare soil, and that to this and other causes the increase in rain fall is due. Along the line of the Central Pacific railroad, through the Humboldt basin, where the streams have no outlet, but form pools from which the water sucks into the sand or passes off by the slow process of evaporation the pores, or sinks as they are called, are every year enlarging their borders, thus showing that either the loss from sinking into the soil or by evaporation is less than formerly, or else the amount of rain fall has increased, and yet there has been a decided decrease in the number of trees in this almost treeless region. In view of these and other cases which might be cited, it would seem that we have a right to at least doubt the theory advanced, and to suppose that this increase in rain fall is due to other causes than the planting of timber; even if this is correct it is no argument against planting trees for they will all be needed in the future.

HILLS AND DRAFT.

In laying out our public roads, by far too little attention has been given to avoiding hills and decreasing grades which cannot be avoided. This may in great measure arise from a want of a proper understanding of the great increase in draft caused by even a slight rise in the ground. From calculations based upon strict mechanical principals, it is found that this increase is in about the following ratio. Fixing a full load on a good road at 1 on a raise of

1 in 100	it will be	0.90
1 in 50	do	0.81
1 in 44	do	0.75
1 in 40	do	0.72
1 in 30	do	0.64
1 in 26	do	0.54
1 in 24	do	0.50
1 in 20	do	0.40
1 in 10	do	0.25

From this it would seem that on a grade of one foot in twenty-four, the team can only move one-half of its load for a level road. In a great degree

this is due to the force of gravity, but it is not all due to this cause. Emerson, who is good authority, states that while on level ground a horse is equal to five men, yet on a grade of 1 in 10 he can only exert the force of three men, or in other words, loses two-fifths of his power from a forced change in the position of his body, which is such as to prevent his throwing his full weight and force on the collar.

The amount of draft required to move a given load up an incline of a given number of feet to the hundred may be calculated, but it will of course vary with the kind of wagon, condition of road; where the road is rough or the wagon is out of order the friction is very much increased and must be added to the resistance of gravity in estimating the force needed. In a good well greased wagon and on a reasonably good road one ton may be taken up an incline of ten feet in one hundred with a direct draft of two hundred pounds or one-tenth of its weight. Under similar circumstances it may be taken up an incline of five feet to the hundred by a force of one hundred pounds. In estimating the hindrance in moving a given weight for a certain distance it is to be remembered that we can only load to suit the steepest grade and no matter if the distance be twenty miles, we cannot put on a load heavier than that suited to a grade of thirty feet on every hundred if such a grade exists on the road. An irregular surface does much to increase the draft. Taking twenty-one hundred pounds as our load, we find that on a smooth steel railway it may be moved by a draft of eight pounds, and well-made pavement by thirty-three pounds; on a road of broken stone by sixty-five pounds and on a gravel road, land or earth by a force of 147 pounds; in the latter case requiring one-sixteenth of the load in draft and in the first only $\frac{1}{280}$ part of it. To a certain point, the higher the wheels the easier the draft, but after the line of draft is parallel to the road bed then any increase in the size of the wheels is a disadvantage. Other things being equal a small axle is better than a large one for it causes less friction. For the same reason iron or steel is better than wood.

BELLA.

DISPOSITION OF FOOD IN A COW'S STOMACH.

BY CHARLES B. MECHENER, V. S., CLINTON, N. J.

The questions under this head have received the attention of more than one writer, and different answers; yes, very indefinite ones have been given. Some of the writers have attempted to answer the questions in full, but have only succeeded in confusing still more the minds who had, possibly, before some definite knowledge of the parts under discussion. Others again have given a long and very good description of the structure of the separate stomachs, but have studiously avoided giving plain, simple answers to the most important questions.

However I think it prudent, before going any farther, to call your attention once more to the anatomy and physiology of the separate compartments which go to make up the stomach of ruminants, paying particular attention to the disposition of the *orifices* and channels through which the food must pass on its way to the *abomasum* or fourth stomach. Looking first at the external surface of the stomach of an ox we observe that it is composed of four separate pouches, which are regarded as so many stomachs, and bear the names of *Rumen, Reticulum, Omasum* and *Abomasum*. The fourth stomach alone should be considered as the true or digestive stomach. The interior surface of the *rumen* or paunch presents two sacs formed by septa, and are called right and left sacs. The surface is covered by numerous papillary prolongations of the mucous membrane, more numerous in the right than in the left sac. At the anterior extremity of the left sac we observe two openings: one is the *œsophageal orifice*; the other placed below and opposite the preceding forms the communication between the first and second stomachs; it is a very large opening circumscribed below and on the sides by a septum or semilunar valve, resulting from the junction of the walls of the rumen with those of the reticulum. The second stomach or reticulum is the smallest and presents on its internal surface numerous polyhedral cells, which in their regular arrangement look like a honeycomb. From the bottom of these cells spring up long, conical, and very pointed papillæ. The interior of the reticulum communicates with the left sac of the rumen by an orifice, already described, and with the omasum or third stomach by a particular opening. This opening eight or ten times smaller than the preceding is connected with the œsophageal orifice of the rumen by a remarkable groove or channel, which merits a separate description.

Œsophageal Groove, so called because it appears to continue the œsophagus to the interior of the stomach. It extends on the lesser curvature of the second stomach from the opening of the œsophagus into the rumen, to the entrance of the third stomach, measuring from six to eight inches in length. This demi-canal is directed from above downward and from left to right, between two movable lips, which are fixed by their adherent border to the superior walls of the second stomach. These lips are thickened at their free margins, which look downward and to the left. At their origin (the opening of the œsophagus) they are thin and but slightly elevated; but they become thick and salient on arriving near the orifice of the omasum or manyplies, the orifice between the second and third stomachs, which orifice they surround, though they neither meet nor become confounded with each other.

The *omasum* or *manyplies* offers a most curious arrangement, it being filled by unequally developed leaves or folds of the mucous membrane, which follow the length of the cavity. These *laminæ* have an adherent border attached either to the greater curvature or to the faces of this stomach, and a free concave border turned toward the lesser curvature, (the part which looks downward and responds to the reticulum.) It is along these free borders that some particles reach the fourth stomach so quickly, not having been caught by these folds and retained in the manyplies. The faces of these leaves or folds are studded by a multitude of very hard papillæ, resembling grains of millet, and which are more developed and conical on some of the leaves than others. Two apertures are seen in the interior of this stomach. The left orifice opening into the second stomach, already described, and a right one much more narrow than the left, which opens into the abomasum or fourth stomach.

Abomasum.—This being the true stomach of ruminants, the mucous membrane lining its interior acquires all the characters which belong to that of the stomach of carnivora, or that of the right sac of the horse's stomach. This stomach has besides the orifice which connects it with the third stomach—another aperture—the *pylorus*, or opening into the intestines. To make the answers to said questions still more authoritative, I will give a very concise description of the functions of the stomachs. The rumen is the pouch where the ailment taken during feeding time is kept in reserve, and whence it is carried again into the mouth during rumination, after having been sufficiently moistened or softened. The second stomach participates in the function of the rumen, to which it is only a kind of diverticulum. The contents of the second stomach is much more liquid than that of the first or paunch. The manyplies completes the trituration and attenuation of the food by pressing it between its leaves. The abomasum or fourth stomach acts as a true stomach, being charged with the

secretion of the gastric juice; in this stomach occur the essential phenomena of gastric digestion. Supposing now that the disposition of the stomachs as well as their functions is thoroughly understood, we are ready to give the answers to your questions:

1st. Does meal pass directly on to the third stomach, or manyplies, and through them into the fourth? All substances swallowed for the first time, while feeding, pass into the rumen and if of sufficient bulk remain in the first and second stomachs until they are taken back to the mouth to be remasticated. Owing to the continual action of the stomachs—contraction and relaxation of their muscular fibres—a small portion of the food passes through the series of openings to the third and fourth stomachs, only being masticated once. Food that has been re-chewed passes through the œsophageal groove immediately into the third stomach and through this into the fourth.

2d. Can it pass into the fourth without passing through the manyplies proper?

No; all food to reach the fourth stomach must go through the third. It may pass along the free margins of these leaves or folds and not be taken up between the leaves. Only small portions of the food can pass this way.

3d. Can we force it by an admixture with coarse food to remain in the first stomach until re-chewed; and if so would it be advantageous?

The meal being mixed with coarse food would not be so liable to become dissolved in the liquids of the stomach, consequently it would, more of it at least, be returned to the mouth and undergo a second mastication. As the saliva would by re-chewing become more thoroughly and evenly mixed through the food, and since this is positively necessary to a healthy digestion and to its own action, namely, to convert starch into sugar, &c., the just inference is that it is advantageous.

4th. Does the second stomach serve as a separator of the coarse and fine food?

No; it does not separate fine from coarse food.

5th. What is the duty of the manyplies; and can they be reached by purgative drenches when impacted by dry murian, or similar diseases?

The function of the manyplies is to triturate and attenuate the coarse and hard particles of food. A similar office is performed by the gizzard (*ventriculus bulbosus*) of birds. An impacted condition of the third stomach is very difficult to relieve, only yielding to the most powerful purgatives and frequently anæmas. These measures if not applied at an early stage of the disease frequently fail to have any effect whatever on the dry and hard condition of the food in the manyplies.

The proper establishment for catharsis in bovine animals, during the existence of disease is frequently an affair of great importance; but from the

enormous quantity of injesta which the stomach usually contains in its first and third compartments, combined with an acknowledged insensibility or indisposition to respond to the action of medicines, it is also apt to become one of great difficulty. It is decidedly unsafe, as a rule, to rely on small and repeated doses of cathartic medicine; such are usually absorbed, and failing to remove the obstruction as purgatives produce a mischievous depressant effect by impoverishing the blood, through which desirable results are not unfrequently removed to inaccessible limits. A full strength cathartic should be given into which enter a variety of purgatives such as salines, mercurials, vegetable, cathartics and stomachics, when we have this impaction of the omasum, as it is properly called. In no cases should the cathartic be repeated. Stimulants are indicated as there is always a tendency to paralysis of the coats of the stomach. Anæmas should be given frequently, and the body kept warm by rugs and blankets.

To answer the first question, the cow has not the power to direct food to the first or third stomach at pleasure, but its destiny depends almost entirely on its bulk. Again, when cows eat rapidly and with their heads held low, most, if not all of the food then eaten goes to the paunch or first stomach. Of course from the vermicular motion of the stomach some of this food finds its way into the third, through the second stomach, in a very short time. Now one reason why food that has been remasticated passes directly into the third stomach is this: If thee has noticed, and undoubtedly thee has, the cow when about to swallow her cud, extends her nose and head, seemingly on purpose, though manifestly by instinct to straighten the direction of the œsophagus. This traction on the stomach, through the tension on the œsophagus, brings the œsophagael groove more directly in contact with the opening of the œsophagus into the rumen. From this contact or connection a continuous passage is made to the third stamach, and it is through this passage that the food reaches the third stomach after having been rechewed. Do not think that those who advocate meal feeding exclusively have any very good reasons to offer on their side of the question. They admit that a cow thus fed does not chew her cud. As I showed in the article I sent thee, this act of rumination is positively essential to healthy digestion. Again, to have rumination you must have bulk and quantity of food. This you cannot get unless your meal is mixed with some coarse bulky substance. As to throwing out of use entirely the paunch I think 'twould be well for us, with our finite minds to recognize the wisdom of the infinite One, by carefully studying the functions of these different compartments, and not pretend to more knowledge than our Maker and discard entirely one or more of these stomachs. In the manifold the food does not pass from one compartment to another directly, but is taken up between these leaves; is triturated, drops back into the channel and may again then

be hooked up by the next compartment and so on. Some of these compartments have at their base little sub-compartments, made by a very narrow leaf or fold. Where we have "impaction of the third stomach" as a disease, *per se*, then this condition of impaction is due to the causes thee mentions. This stomach very frequently becomes impacted during acute febrile attacks, and is at times a very serious complication. The tendency to impaction of the manyplies during any febrile disease has led me to adopt the practice of administering a full dose of cathartic medicine—1½ to 2 pounds of Epsom salts—at the very commencement of the attack, whether the condition of the bowels call for it or not, and thus far I have had only favorable results from this plan of treatment. During fever all the secretions of the body are checked, hence this tendency to "impaction." To recapitulate on the act of swallowing: 1st, coarse, bulky food chewed for the first time passes into the first stomach. 2d, fine, moist food passes, some into first and a greater portion directly into the third stomach. 3d, remasticated food (from its mechanical condition, aided by the position relative of the mouth of œsophagus and commencement of œsophageal groove, produced by the extension of head and neck,) passes directly through the œsophageal groove into the third stomach.

HOW SHALL WE BEST KEEP OUR BOYS ON THE FARM?

BY HOWARD PRESTON, WESTGROVE, PA.

Whether it is best they remain upon the farm may be an open question, and one that few thoughtful parents would undertake to decide for their children.

I have known cases where the strong stern will of the father laid down the law, that all *his* boys should be farmers. And farmers they were in the common acceptation of the term, but not in spirit or in thought, and in the end failing in that success which is likely to follow the person who is in his true business.

Assuming that our boys have no particular desire or talent in any other direction, believing that farming is an honest, respectable business, which though laborious pays on the average as well as any other for the amount of capital and brain power invested, it is but natural that when we see so many of our boys leaving home and their fathers' pursuits to go into the professions and trades which are as full of care and anxiety and in the end no more certain of attaining success, that we inquire, Why is it so? What is the reason?

In the first place we have this difficulty to contend with. That boys as a general thing do not incline to the business that their fathers follow.

The blacksmith's son seeing how hard his father has to work, how dirty and grimy he looks, concludes very early in life that whatever else he may be, his will not be the life of a smith.

The son of the shoemaker seeing his father confined in the close pent up shop, through the beautiful spring time, through the lovely summer and delightful autumn, soon decides that he will follow some business less confining.

Ross, said I the other day to the doctor's son, a bright boy of 10 years, who was holding his father's horse. When thee gets to be a man, will thee be a doctor? "no, sir," was the decided reply.

The parents complain that their business is hard, wishing they had pursued some other calling, thus making boys feel that any business is to be preferred to their own.

As a class none are better adepts at complaining than farmers. They complain of the wet weather, and of the dry weather; if the spring opens

early, they fear the fruit will be killed; if late, that the crops will not be planted in time, making themselves and their families uncomfortable by their continued complaints. The boy hearing such dismal stories soon decides that when he goes into business, it will not be one that is affected by frost and rain, by storm and heat. They see the dark side of the picture, and parents, if they are wise, will try and show them that there is a bright side also.

We must try and make home the most pleasant place, encircling it with love, with mutual kindness, giving to our children that measure of courtesy and politeness that we mete out to those outside of our household, freeing the child from the restraint that makes it afraid to talk in the presence of its parents. To be sure if children are allowed to converse unrestrainedly they will often say unwise things—sometimes talk when you wish they would keep silent. But it is only by this freedom that we learn the thoughts of the child, its tastes, its needs; and it is only by knowing these that the parent can understandingly govern, train and instruct.

Let home be the place where the evening lamp burns brightly in the most pleasant room, a place where the best is not too good for the children, where interesting books and magazines, innocent games, sweet songs and instructive conversation fill up the long winter evenings. Let homes be the centers from which spread out love, pleasure and knowledge.

Not only this, but the surroundings of our homes should be made as attractive as our means will admit. A few ornamental trees, a neat lawn cost but little compared to the pleasure they bring. I believe nothing pays better.

Give the boys, and the girls too, a chance to make something by their own efforts, rather than grudgingly give them spending money, and you will see how carefully and wisely they spend it. If the boys and young men of the present time bought with their own earned money the fine turnouts they drive, instead of their indulgent parents, how much more cheaply would they ride, and how much more wisely.

Give the children a share in the profits of the poultry or the market garden, and you will see with what zeal they feed the chickens and hunt the eggs, with what interest they plant and watch the growth of sweet corn and Lima beans.

I heard some one speak not long since of the disadvantages resulting from sending our children away to get an education. I believe if we had good, live schools at home, where the boys and girls could have an opportunity of receiving that kind of knowledge that makes them think and see, that kind of education which meets the every-day wants and need of the working people, it would be better for us and for the children. Sending them away from home at a time in life when they most need the care and

counsel of their parents; at an age when they are most susceptible to the influences that surround them, is a risk that often results disastrously.

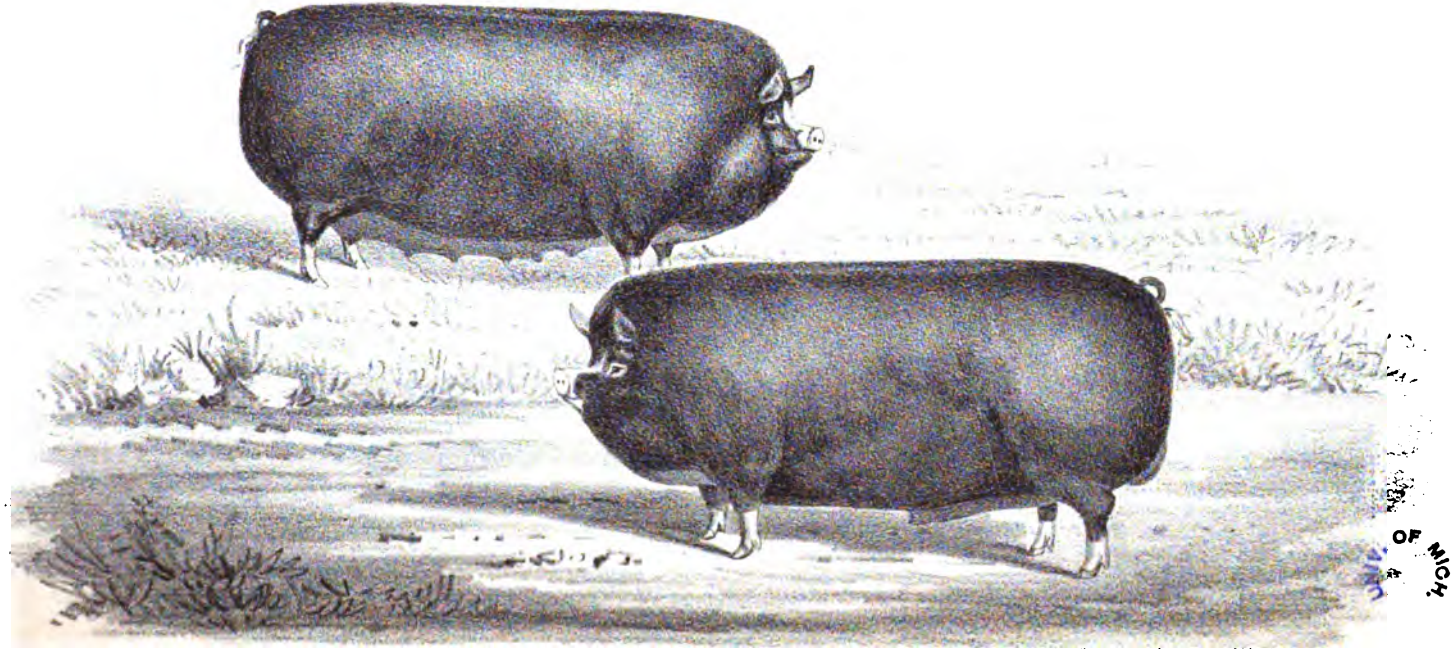
Let us resolve then to have better schools at home—the public schools—so that our children can get a thorough English education, and if we were as earnest as we should be, we would see to it that the practical branches were taught more and the useless less. Instead of devoting so much time to the study of geography and mathematics, which in nine cases out of ten are thrown aside the last day of school never to be called into use again, let them learn more of the things around them—of botany, of geology, of entymology, of astronomy—so that when the children see a tree or plant or flower, they see it not as a thing having no individuality, but as an acquaintance who has a name and a family. When they see the soil they work amongst, it is not simply dirt and stones, which have no history, for to one who has studied of these things, each formation has its own grand story.

When they see the insect world around them they are not simply *bugs*—but a portion of God's handiwork, each species having its peculiar habits and uses, if we were wise enough to find them out.

When he turns his eye heavenward it is not simply stars that he sees, but those grand constellations as they make their stately sweep around the centre of our universe. He sees Orion, the Pleiades and Aldebaren, as they appear again after an absence of months, and his heart bounds with delight as he views again these familiar friends, and he early begins to comprehend, somewhat dimly to be sure, something of the vastness and grandeur of the universe

And whither they look, up or down, to the right hand or the left, they see on every side that of which they know something and in which they feel an interest.

This, it seems to me, is more the kind of knowledge we need to give our children, and which, with keeping our homes attractive and ourselves in sympathy with them, will keep our boys at home, if farming is their true calling, if not, and the boy still wishes to follow other pursuits, then all that remains for the parents to do is to give him their blessing, and let him work out his destiny.



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UNIV. OF MICH.

THE RUMINANT'S STOMACH.

BY E. MICHENER, M. D., TOUGHKENAMON, PA.

In presenting a few desultory remarks on the anatomical structure, and physiological functions of the stomach of ruminating animals, I wish to express my very high appreciation of the paper you have had from my cousin, Charles B. Michiner, V. S. I may sometimes have to cross his path from inability to adopt his conclusions upon the evidence which I am in possession of. It need not be any cause to wonder if *he* should sometimes be misled by authorities, or fail to discover all the meanderings of intricate, and often untrodden path which leads to physiological truth. Nor can *I* hope to be more successful.

The subject is intrinsically difficult. It is, perhaps, impossible, without resorting to the most cruel and difficult vivisections to observe the relative positions, and to see the anatomical mechanism of these complicated organs. Without such aid the *peristaltic action* of the muscular apparatus, with which they are so plentifully supplied, can only be inferred from their anatomical arrangement, and the resulting effects upon the food in its passage through them. Nor can we very accurately note these changes by a *post-mortem* investigation. After the death of the animal the whole muscular system is relaxed and powerless. Even the sphincter muscles—those trusty sentinels and gate-keepers who have faithfully watched and guarded every improper ingress and egress through the various channels of communications between the several stomachs—are now dead, and permit their respective contents to mingle with each other, during and after the death struggle.

My own personal knowledge of the matter is quite limited. I shall, therefore, avail myself of the observations of others, and where these prove unavailing I shall endeavor to reason from the *known* to the *unknown;* from the *means* to the *end;* from the *organism* to the *organic function*. In this way I hope to reach important inferential conclusions, not otherwise attainable.

Adaption is Heaven's first great law. It is a law of the Divine government that the means shall be adapted to the end, and in obedience thereto, we find that the digestive apparatus of the various races of animals is constructed on the plan best adapted to the food they were designed to feed upon. We are now specially interested with that of the ruminating class—the ox and the sheep. The complication of the stomach in these

animals is in direct proportion to the coarse and bulky food upon which they ordinarily subsist—grass and hay. The *stomach* (improperly so called) consists of four distinct sacs or pouches, but the *first* and *second*, and even the *third* also, more immediately supplement the *masticatory* than the *digestive* functions. The last of the series is only, and exclusively THE STOMACH. The three preceding ones bear about the same relation to it that the *crop* does to the *gizzard* in granivorous birds. These prefixes to the true stomach are only found, as has been mentioned, in those races of animals which are destined to feed on course and bulky food, and obviously are not designed to digest the food, but to *reduce* its bulk, to *soften* its woody texture, and to *prepare* it for digestion. They are only *accessory* organs. Youatt says: "These three stomachs are evidently designed for the preparation and comminution of food before it enters the fourth stomach, in which the process of digestion may be said to commence."

If this view is correct, the inference would seem to follow, that whenever, and so often as a portion of the food has become fitted for the digestive process, whether from its own nature or by the combined operation of the preparatory organs, it should be, and is, forwarded directly to the fourth, or true stomach. And to secure this object, the power of deglutition is so modified that the animal can at will deposit the substance swallowed in either of the stomachs where it most properly belongs. My cousin says: "The cow has not the power to direct the food to the first or third stomach at pleasure. It depends almost entirely on the bulk." No matter, cousin, on what it may depend; only concede the power. "In the calf fed on milk," Youatt says, "its food all goes on to the fourth stomach," and adds, "the instinctive closure of the pillars—an act of organic life—has far more to do with the direction of the fluids, than any mechanical effect resulting from the form of the aliment, or the force with which it descended the gullet." And so of the remasticated food of the adult, "being of a softer consistence, or not being so violently driven down, or by some instinctive influences, it passes over the floor of the canal without separating the pillars and enters the manyplies."

Whether it is owing to some extraneous excitation which different conditions of the ingesta produces on the organs of deglutition, whether it is a mere instinctive action of those organs, or whether it is an act of volition on the part of the animal, the fact must be conceded that the animal can, and does in the ordinary act of deglutition, direct the food to whichever of the stomachs it is fitted and adapted for. And this is the stand point from which I shall call your attention to the further consideration of the subject.

The anatomical descriptions furnished by my cousin, have been adopted as the basis of these physiological notes.

I. OF COARSE BULKY FOOD—GRASS AND HAY.

Food of this discription is hastily swallowed without much mastication and passes directly into the first stomach. After maceration, for a longer or shorter period, as it is more or less rigid and unyielding, the aid of the second stomach is called into requisition, as the essential organ of remunation. By the joint peristalic action of the first and second stomachs, a portion of the ingesta is separated from the crude mass in the former, and is received into the latter through its large orifice, where it is compressed, its finer parts squeezed out and then rolled into a compact ball, or cud, small enough to repass the smaller orifice, which is "eight or ten times smaller" than the one by which it had entered. It is then ejected from the second stomach into the œsophagal canal and is immediately regurgitated to the mouth to undergo a through remastication, while the finer and more fluid part which are pressed out during the manufacture of the cud are forwarded to the fourth stomach, to make room for a fresh supply of cud material from the paunch to run the same course. I conceive this to be the important function of the second stomach. It is practically a cud-maker.

My cousin in his resume of the functions of the stomach says: "The rumen is a pounch where the aliment taken during feeding time, is kept in reserve, and whence it is carried again into the mouth." He hardly seems to find a use for the second stomach, except that "it participates in the function of the rumen, to which it is only a kind of diverticulum." Dr. Rogert, however, says in his Bridgewater Treatise on Animal and Vegetable Physiology. "The food contained in the paunch is transferred by small portions at a time into the second stomach, in which there is always a supply of water. It is in this latter stomach that the food is rolled into a ball and thrown up through the œsophagus into the mouth, where it is again masticated."

When masticated the bolus is again swallowed, but instead of entering the first stomach it is now passed on along the œsophagal canal, and falls into the third stomach—the manyplies—which it is manipulated between the laminæ of the viscus, acting as so many millstones, or raspatory plates, grinding and reducing it still more to a pultaceous mass. As this grinding goes on the finer parts escape along the free edge of the laminæ, and pass directly into the fourth or true stomach, and is there subjected to the solvent action of the gastric juice. Youatt says: "That which is quite ground down is permitted to pass on." A brief study of the pathology of hoove in cattle may illustrate my view of the function of the second stomach. When coarse food, especially clover, is greedily eaten in inordinate quantity, the first stomach may become so impacted and so compress the second as to interrupt the cud making process. Fermentation of the succu-

lent mass is speedily induced, and the evolution of gas as rapidly ensues. The pressure from within closes the valvular passage to the second stomach, so that nothing can escape in that direction.

This is hoove; the animal is hooven, and death may soon relieve its suffering unless proper remedies be employed. Here the proximate cause of hoove would seem to be the inability of the second stomach to receive the material and to manufacture cuds.

II. OF MIXED FOOD—CUT HAY AND MEAL.

Still holding the position that the animal in the act of deglutition can convey the bolus to either of the stomachs, according to its fitness for their reception, if the mixed feed is so coarse and stubborn as to require maceration and re-chewing it will be lodged in the first stomach and subjected to the routine already described—with this probable exception; the second stomach, in making up the cuds, will press and wash out the meal from the hay and allow it to pass on to the third stomach. But the meal does not require trituration in the manyplies and is passed on along the free margin of the laminæ to the fourth stomach. True, my cousin says, "no, it (the second stomach) does not separate fine from coarse food." But I cannot conceive that nature or the God of nature, who does nothing in vain, should require the animal to re-chew the meal already fitted for digestion.

III. OF CONCENTRATED FOOD—MEAL, ETC.

Assuming the correctness of the previous views, we must in this case ignore the functions of the first and second stomachs, and can do no more than claim the right of way for the meal along the pharyngial canal and round the loose edges of the laminæ of the third, to its final destination in the fourth stomach. The disposition of prepared concentrated food is essentially the same as in animals with a simple stomach. My cousin almost admits this when he says: "It is along these free borders that some particles reach the fourth stomach so quickly." Many thanks, Doctor. But if some do this, why may not more do the same? He answers why and because, "The act of rumination is positively essential to healthy digestion." This can hardly be asserted when there is nothing to ruminate.

IV. OF MILK FOR THE CALF.

Here all the three preceding stomachs are practically rudimentary, and the milk consequently is obliged to pass directly into the fourth stomach—the only one which has attained a functional development. Dr. Roget says: "There is a direct channel of communication between the œsophagus and fourth stomach, along which milk taken by the calf, and which does not require to be either macerated or ruminated is conveyed." And

why should not the same thing occur in after life, when the animal is fed on food which does not require either maceration or mastication?

Despite these evidences my cousin enters a *non sequitur*. "It would be well for our finite minds to recognize the wisdom of the Infinite one * * and not to pretend more knowledge than our Maker, and discard entirely one or more of these stomachs." Good! but wherein does the wisdom of the Infinite One manifest itself more forcibly than in the judicious adaptation of the means to the end in all his works? It would mar the evidence of his wisdom to see a cow chewing a cud of meal. Why is it that the fishes of Madison's cave, which have been kept in utter darkness for untold centuries have ceased to possess eyes? Simply because they would be useless to them. So also of the milk-fed calf and of the milk-fed cow. The three accessory stomach being unnecessary and unused, would soon cease to be developed and remain rudimentary, or, perhaps, like the eyes of the fishes, would in the progress of time, become entirely extinct.

V. OF DRINKS—WATER, ETC.

Water is said to always enter the second stomach. In addition to the general purpose of supplying the continual waste of fluids in the organism, this organ may possess the faculty of dispensing water *pro re nata* to the other stomachs as occasion may require. A portion of water must also assist in cud making, by separating and washing out the finer and insolvent parts. In confirmation of this view my cousin says, "The contents of the second stomach are much more liquid than those of the first." Then let me ask what becomes of the liquid portion? for it does not appear to enter largely into the composition of the cud.

Although our paths have sometimes seemed to diverge, yet you will perceive that we have reached very nearly the same conclusions, when I reiterated his concluding paragraph: "To recapitulate the act of swallowing: 1st. Coarse, bulky food, chewed for the first time, passes into the first stomach. 2d. Fine, moist food passes (some into the first, and a greater portion) directly into the third stomach. 3d. Remasticated food passes directly into the third stomach. If my cousin will just allow me the liberty to put "some" in the same receptacle with the "greater part" we can cordially shake hands over it. What I have placed in brackets, appear to be so many supernumerary words, and only mar the sense.

We thus have what I conceive to be a pretty correct general view of the anatomy and physiology of the digestive organs of the class ruminantia, or the ruminating animals. But the organic arrangements, and functional methods vary continually with the species. The peculiar wants of each requiring some especial adaptation of structure and use. As a striking instance—the mere honey-combed cells of the second stomach of the

cow become greatly enlarged in the camel, and are each one furnished with a sphincter muscle or drawing string, which enable them to hold a supply of water and to dispense it for use during long journeys over the arid wastes of Africa. How far the structure and functions of these cells in the cow may co-ordinate with the same organism in the camel, I am unable to determine. The analogy is very strong. The disproportion in size is more difficult to assimilate.

DRAINS AND DRAINING.

BY THOS. J. EDGE, LONDONGROVE, PA.

Our average soil possess a capacity for absorbing and holding by capillary attraction alone, at least three gallons of water to each cubic foot; this is far beyond the requirements of vegetation and the surplus must find an outlet or our crops must suffer. On our uplands we have but little trouble from this cause and that little is only due to local causes which do not come directly within the province of my essay; on such land the surplus water finds its way through natural channels or by the much slower process of infiltration, to the low lands and valleys where it must find an outlet or cause trouble to the farmer. In some cases this outlet is found in a creek or other moderately deep channel and no injurious accumulation takes place; in other cases the outlet is only found at or very near the surface and a swamp is formed, or a strata of clay or impervious soil intervenes between the source of supply and its natural outlet, and by raising the surface a lake or pond is formed. We may then assume that in all low lands the surplus water from higher lands, as well as that which falls directly upon their surface, attains what may be termed water level, and that this level raises and falls as the supply increases or diminishes. In fact, we may assume that this level exists in *all* soils but that in many it is so far below the surface as not to interfere with our farm operations. It is evident then, that the object to which our attention must be directed, is to furnish this surplus water with an artificial outlet by which it may pass off as fast as it is received and no matter how we accomplish this, we are to all intents and purposes engaged in *draining*. But few plants can flourish on stagnant water, and our farm crops are not among these favored few; stagnant water prevents the free access of air and it is to this that its main disadvantages are due. In all soils any surplus of water decreases the temperature, and hence, retards the crops to an equal degree. Actual experiment proves that a cubic foot of average soil taken during a dry time and thoroughly pulverized, will absorb and hold, by capillary attraction alone, at least three gallons of water; if no outlet is afforded for this it must nearly all evaporate before a plant can thrive; in all cases of the change of a liquid to a vapor, a large amount of heat must be obtained from some source, and in this case it must come from the sun through the medium of the soil; careful estimates go to show that the evaporation of one pound of water from one hundred pounds of earth, will require an equivalent to at least

ten degrees of heat, or that in other words that it would lower the temperature of the soil just that much. Careful experiments in draining large areas in England, demonstrate that while the drained soil maintains a temperature of 66°, an adjacent and similar one undrained never raised its temperature above 47°, making a difference similar to that claimed above. Any practical farmer can judge from his experience of the effect upon which such an increase would have in starting the crops in the spring or in perfecting them in the fall.

While the effect of drainage in removing the surplus water is generally understood and appreciated, its effect in preventing the bad results of long continued dry weather is not properly valued. Wherever water can find its way air will follow; the water finding its way into the drain leaves diminutive avenues by which the air enters. Air in its unoccupied state, even in the driest season always contains more or less moisture, and coming in contact with the cooler earth, much of this moisture is deposited, as is the case, upon the outside of a pitcher of ice water. Experiment demonstrates that one thousand grains of thorough aired soil, if exposed to the air, but protected from dew and rain, will absorb twenty-five grains of moisture in twenty-four hours, and that for agricultural purposes it is benefited by just that much. This power of absorption varies with the nature of the soil being greatest with stiff clays and least with light sandy ones, while pure sand exhibits no capacity in this direction. In addition to the moisture obtained by a drained soil in the way described above, it also acts as a sponge and by capillary attraction draws moisture from the sub-soil below.

In England the benefit to be derived from drains against drought seems to be much better understood than here, and is carried into practice in many cases by the thorough drainage of uplands on which no surplus water could possibly stand, and where the whole benefit must arise from the protection afforded in this way. One advantage which the English farmer posesses is the low rate of interest, and this taken in connection with low rates for labor and high values for land, no doubt produce him a profit from a source which to us would result in loss, but this argument cannot be used against the drainage of low or wet lands. In answering the query as to what land needs draining (and consequently what land will pay for it) it must be remembered that while our cultivated crops will usually by their appearance show the presence of surplus water near the surface yet they are not an invariable index for the improving farmer. Land not positively wet, under all circumstances may, and often will, be so for several days after a heavy rain, and the damage done during this interval may more than compensate the whole cost of drainage. Trial holes may be sunk at various stations over the doubtful area and if after four or five days water stands in them within two and one half feet of the

surface a system of drains will soon return the cost. In fact I am not certain whether we might not safely add another six inches for we do not fairly appreciate the depth to which the roots of our crops will go in pursuit of moisture. My rule has been to go as deep as the outlet would permit, until a depth of three feet was reached, but with good digging I am by no means certain whether true economy will not dictate a greater depth accompanied with a corresponding increase in the distance apart.

Having settled all matter of theory, and having arrived at a conclusion to put in the drains, the next point is to decide upon the direction and number. As a rule, the lowest point is the place for the outlet, and in no place (unless positively unavoidable) should even the drain at the outlet be less than two and one-half feet deep. If possible, deepen the creek into which it empties for a less depth, you can never feel safe against obstructions. In one or two cases we have been compelled to be satisfied with less, but in every case in which we have had any trouble, it has been with shallow drains. A multiplicity of outlets is to be avoided, and hence, in any considerate area, there should be a main drain into which the mian, or smaller drains, should empty. In all cases the majority of the drains should run directly up and down the greatest ascent; or, in other words, up and down hill. If run across the line of any considerable fall, the water will percolate down hill and at right angles to the line of the drain, and when the fall of the drain is but slight, it has been known to interfere with the crops before reaching the next drain below. In some sections it is customary to throw considerable of mystery around the operations of draining, and to hold out the idea that an "engineer" should be employed at a considerable increased expense. In our operations we have never felt the need of such aid, and our only motto was to always "keep the water running down hill;" with this object in view, any ordinary intelligent farmer is able to lay out his own drains. Nor have we ever found it needful to use any complicated instrument for leveling; we want no better level than the water running in the bottom of the ditch, and if it is only kept running down hill the desired end will be reached. When the fall is very slight, a level will be needed, but such cases occur so seldom on the farm that they are excepted to the general rule.

For digging the ditches I have seldom been so situated that I could use anything but a man and shovel, when the nature of the ground will admit of its use, a common plow drawn by a steady team will materially reduce the expense, but on soft soil or with short lines of ditches, the lost time and danger of accident will more than counter-balance the other items. After a fair trial of both plans, I must admit that I am not prepared to decide whether it is best to obtain the labor by the day or pay for it by the rod, there are many arguments upon both sides, but in all cases where the

work was done by the rod, it ended in my employing men by the day to make changes and do work "not in the contract," in some cases I have lumped the job in one sum, but found it to be the most objectionable of the three plans. If the area to be drained is of considerable extent and it seems certain that the digging will run about the same over the whole tract, it will probably be found most satisfactory to put it out by the rod, and the bargain may or may not specify for the filling in of the ditch, but in *all cases* the proprietor or a trusty hand employed *by the day* should lay the tile and cover in the first inch or two of earth; always, whether done by the job or day, I do this myself, and would not feel safe to include it in a contract by the rod. The proper width of the trench will, in a great measure, depend upon the workman employed—especially if he works by the rod, but in either case, it is to his interest to move as little earth as possible, and hence dig the ditch narrow. In all cases of work by the rod I always stipulate that the ditch shall increase in depth from the outlet as rapidly as is consistent with the proper fall to the depth decided upon, and then be carried at that depth as nearly as the surface will allow. As to width at the top, I say nothing, and only stipulate that a common fence board six inches wide shall lay on the bottom without any springing sideways; this practically gives me six inches in the bottom, which is more than I absolutely need for tile, but is about as narrow as a man can work; in fact but few go less than eight inches. When there is much variation on the surface, the average depth must be taken as a guide, and may vary from two and a-half feet upward.

Of the various materials used for drains, such as brush, poles, boards, stones and tile, I have used but two, and find but one thoroughly satisfactory; the few stone drains, either from some fault in the construction or of the material, have never proved satisfactory and have all been replaced by tile. Among the disadvantages of stone may be enumerated the increased width of the ditch (nearly double) which involves the removal of a greatly increased amount of earth, the increased amount of time expended in laying them, the increased danger of stoppage from surface water breaking in, and the danger from mice burrowing down to them. Another important item when the drains are necessarily shallow is that the stones are more likely to interfere with the future plowing and are more liable to be displaced; when an open space, formed of large stone, is used the sides are liable to be undermined by the running water and thus interfere with the action of the drain, if not to destroy it altogether.

If two-inch sole tile can be obtained at two cents per foot I would not use stone, for I am thoroughly convinced that the items to which I have alluded, will more than counterbalance the first cost of the tile. I know that in this point many of my readers will differ from me, but I think when

they consider that the digging is much the most expensive item, and that it will cost nearly twice as much to dig a ditch sixteen inches wide as when eight inches wide, they will admit that the tile are the most economical in the end. After deciding upon tile as the proper material for use, the manner of laying forms the next important item for our consideration. Whether boards should be used on the bottom, depends very much upon the condition of that bottom; if quicksandy, they will be indispensable, and in many cases a single one will not be found sufficient; in some cases we have found it absolutely necessary to make a continuous box or trough in which to lay the tile in order to make it stiff enough to sustain itself. In other cases we have been forced to haul stone in and ram them down until a solid foundation was obtained, but thus far, we have been so fortunate as to cross such spots nearly at right angles, and not to have any considerable depth in any one ditch. It must be kept in mind that a drain, like a chain, is only as strong as its weakest link, and that one tile displaced in a quicksand destroys the whole as effectually as if all were broken. When the stream is constant, almost any kind of timber may be used, for, when kept wet, even hemlock will last for an indefinite length of time, and by the time even the worst decays a deposit of mud will have been formed which will afterward sustain the tile in its proper position so long as no direct agency moves it. In laying the tile, we make it a rule to commence at the upper end of the ditch and lay them down to the junction with the first or upper side drain; for this work, a sharp, heavy hoe to level the bottom and scrape the loose earth down the drain, will be of use; a heavy hammer to sink projecting stone will also be needed. At the junction of each side drain with the main one we build a box or "trap" of hard burned brick, using for the purpose from six to ten brick; if the bottom of this "trap" is scooped out below the level of the drain, the depression will arrest all sediment and small obstacles, and prevent their passage down the drain. These traps add somewhat to the first cost of the job, but if in the future anything should get wrong with the drain, they save a large amount of digging, for by opening down to each one of them the stoppage is easily located, and they at all times afford a sure index to the working of the drains. They should be left open until it is certain that all are working properly.

In arriving at a proper decision as to the kind and size of the tile, there are a variety of important items to be considered. In both theory and practice I think it will be found that the ordinary sole tile are the best and most economical; round tile unless laid with collars are more easily displaced and on a yielding bottom do not offer as much resistance to downward pressure; if round tile with collars are used it will increase the cost to a point above that of sole tile; in my case there is but little choice for

the sole tile are the only kind I can obtain without an increase of freight and hauling which effectually rules out any other form. When we remember that a half inch of depression on one rod and the same amount of raises in another closes one inch of the tile I think caution will bear me out in opposing the use of anything smaller than two inch tile on even the smallest lateral drain; it is true that smaller tile cost less at first, are attended with less freight and hauling and *if not displaced* will carry all the water and more too, yet I think they will not pay for the increased danger. In such a job done for a lifetime at least, economy may readily become a mistake and injury. If the purchaser can have the choice of the form of the inside bore of the tile, he should insist upon an egg shape with the smaller or sharp end down because with a small stream, the water will be collected with a narrow and consequently deep channel and thus be less liable to obstructions of any kind.

In many cases much larger tile are used than is needed to carry the water and while I would use nothing smaller than two inch, there are not very many cases in my experience when larger ones were neeeded. In some few cases we have used three and even four inch tile but this was when local causes made a stoppage probable; for main drains we have sometimes used two and one-half inch but often only two inch. With a fall of one foot in one hundred, a reasonably well laid drain of two inch tile will discharge 20,000 gallons in twenty-four hours; one of three inches will under the same conditions discharge over 50,000 gallons. The smaller of these amounts exceeds the usual or even extraordinary requirements of such a drain. It must be remembered that a two inch tile carries four times as much as a one inch one, and that a four inch one will vent four times as much as a two inch one; in fact the proportion carried by the larger pipes is even greater for the allowance to be made for friction is much less.

Practical men seem to vary in opinion as to whether it is necessary to cover the joints of the tile with stone; in practice we have seldom found it needed except in the case of an unusually open joint, and for covers for such a joint we find nothing superior to oyster shells. It must be remembered that the water rises from *below* into the tile, and *not* from above and down into it; hence there is perhaps more danger from obstruction from below than from above. As previously stated, the owner or a trusty day hand should always lay the tile and place a few inches of earth on them. A clod or stone roughly thrown in may crack the tile or even break it in without the injury being noticed—open joints are more likely to escape notice in "job work," and the dangers are materially increased. If there is any great danger of obstruction, it is best to only put in three or four inches of soil and not add any more until all is found to be safe; this covering will make the tile safe and it may remain so for months if there is no freez-

ing weather. All cracked tile should be discarded, and also all soft beamed ones or at least such should be retained for the upper ends of the side drains.

As the depth and distance apart are almost inseparably connected, we can probably best arrive at a conclusion by considering them together. The outlet will in great measure govern the depth of the lower end of the main drain, but in all cases a depth of three feet should be attained *as soon as possible* and still retain the proper amount of fall. Both depth and distance apart must depend upon the nature of the soil and the cost of tile; if the latter are low in price and the digging hard and difficult, it may be economical to place the drains closer together and not so deep; if on the other hand the tile are expensive and the digging easy, the width and depth may be both increased; while I would not wish to be understood as naming a a depth or width for *all soils*, yet I think three feet deep and two rods apart will suit a majority of cases, where the intention is to thoroughly drain *all* the ground.

There are many cases in which a deep drain run at the foot of the high ground will drain a considerable area of a swamp below, but there is always so much uncertainty attending such attempts, that in the end the regular system will be found most economical and satisfactory. In England several systems of drainage having their plan based upon a knowledge of the underlying strata, have been tried but have so often proved fallacious that they have been discarded by practical men. Among these may be enumerated, the Elkington system which proposed to find an outlet for the water by boring down to sand and "by tapping the main spring, remove the cause of the trouble without any further expense," but the "expense" was usually in finding this main spring. Another system known as that of Keythorpe or Lord Bernon's is thus described by one of the best England authorities:

"The peculiarities of the Keythorpe system of draining consists in this—that the parallel drains are not equidistant and that they *cross* the line of greatest descent. The usual depth is three and a-half feet but some are as deep as five or six feet. The depth and width of interval are determined by digging trial holes in order to ascertain not only the depth at which bottom water is reached, but the height to which the water rises in the holes and the distance at which the drain will lay the hole dry. In sinking these holes, clay banks are found with hollows and furrows between them which are filled with a more porus soil."

Under another system known as that of Wharncliffe, it was proposed to sink four foot drains not less than sixty feet apart and at right angles, and into these run small or side drains eight yards apart and only two feet deep. After a fair discussion of all these and other plans, the English drainer now drains the whole ground with a regular series of tile at certain and regular

distances apart, and throws aside all theory and speculation. Can we do better than to follow their example ?

I have stated that the distance apart at which the drains might be placed in a great measure depended upon their depth, and when this is correct, it will be remembered that the character of the soil has much to do with it. In some very stiff clays, drains four feet deep and only eighteen to twenty feet apart, have been found only partially effective, while in other cases of loose soil, drains of the same depth, and sixty feet apart, have been found perfectly satisfactory and efficient. One of the best farmers and practical believers in drains, adopted the rule that establishing three feet deep and twenty-five foot apart a rule, we might safely double the distance for every foot of increase in depth. This seems somewhat extravagant at the first view, but if taken in all, its bearings may not be far wrong. Water will not move on a level, but must have more or less fall ; to move from the middle of the space between the lines of three foot drains, it must start somewhat above the level of the drain ; these lines, from two adjacent drains, must meet at least two feet below the surface, and taking this at the depth at which they do meet, it will readily be seen that an increased depth of one foot will depress this point one foot and admit of a greatly increased length of the line, but that it will bear it doubled, seems too much. If this extra foot in the bottom of a three foot drain costs less than an extra row of tile, the greater depth will be the most ecomomical, but if the reverse is true, it will not be best.

As a rule, I think it will be found that in the same soil and under similar circumstances, a four foot ditch will cost about twice as much as a three foot one, and any one who has practical experience in such work will usually want a double price for the deeper one. In the first place, the extra foot comes out of the bottom and not from the top, and the trench must be started considerably wider, thus involving the removal of much more earth. After a little experience, a practical man will bring his knowledge to bear upon the question, and by first sinking a three foot ditch will be able to determine whether more or less will be the most economical. In many cases the water is forced back by a bed of clay which prevents it from seeking its natural outlet, in such cases it often happens that one drain will relieve a large area of surplus water; as a rule it will not pay to go very deep where the water lays in the bed of gravel, but it is often found in such cases, that ridges of tenacious soil prevent the passage of the water and deeper drains will be needed to release it. Another important item regulating the depth of drains is the liability to stoppage from the roots of the crops or products of the soil, to what depth the roots of our cultivated crops will penetrate into the soil has never been fully determined, but it is well known that some of the semi-aquatic plants which grow in moist

places, will go down to a considerable depth in search for water. One of our most serious cases of stoppage in a three inch main drain was caused by the roots of the common Iron weed, which at a depth of twenty-five inches, passed into the drain and filled it with a mass of fibrous roots extending down ten feet below the plant and up for a distance of four or five feet.

It is important that the outlets should be carefully protected not only against the entrance of turtles, snakes and similar visitors; in one case a small water turtle finding entrance at the outlet, followed the three inch drain until a contracted tile stopped his progress; soon after a heavy rain, we found that the drain was not working properly and was discharging very little water at the outlet; investigation showed that the sudden flush caused by the rain had turned up the front of the dead turtle's shell and formed a nice fitting valve which effectually stopped the drain. It is best to use two or three joints of terra cotta pipe at each outlet, for if the tile are combined clear to the end the water nearly always finds its way around them and damages the outlet; it will pay well to build a dry stone wall for two or three feet on each side of the outlet pipe, in order to effectually protect it from stock.

I have purposely left the question of will it pay? for consideration at the last and with it will include that of cost. First by referring to English data of undoubted reliability, I find that 38 acres drained at a total expense of $252, had its rental value increased from $3 50 per acre to $8 80, and its annual value increased from $133 to $334. Another property of 33 acres by the permanent expenditure of $384, had its annual rent increased $95. Such examples might be multiplied to an almost indefinite extent, but enough has been given to prove that, in England at least, draining pays.

The cost of draining will of course very much depend upon the nature of the soil, rate of wages, cost of tile and similar items. Some of our leading American authorities place the cost per rod of average digging at 43 cents, grading at 6 cents, tiles and expense of laying them at 21 cents and filling at 10 cents, making the total cost 80 cents per rod for a *four foot* ditch. Supposing these drains to be forty feet apart the cost per acre will be $51 20. If we decrease or increase the distance apart we of course increase or decrease the cost. On good authority when the digging was easier and the wages a little lower, it was found that the expense per rod (without allowing anything for work of proportion in laying tile) was 50 cents per rod; the cost of filling being just two cents per foot running measure and the cost of the tile exactly half as much. Based on this data, the cost of one acre with drains 30 feet apart would be $44, at 40 feet apart $31 42, and at 60 feet apart only $22. The same authority gives the average cost for stone drain at $1 25 per rod, thus supporting the opinion ex-

pressed elsewhere that stone was more expensive. Taking a number of English authorities and averaging their estimates for three foot drains, it makes the cost but a trifle over $25 for three foot drains. From my own data I find that without allowing for my own services in laying the tile and superintending the job, it has cost me 70 cents per rod for contract work; of this 50 cents per rod was for digging and filling, and 20 cents for tile and hauling. At this rate for a three foot ditch two rods apart, the cost has average at the rate of $50 per acre. To this must be added the item of boards for quicksands, suspension, &c., making the total $60 per acre.

That it has been done and can be done for less I do not doubt, for my work was no doubt above the average in the difficulty of digging, but with day laborers at $1 50 and $1 25 connected with long and severe struggles with quicksands, I have run the cost up to an average of not less than $75 per acre. Upon the other hand, I once thoroughly drained one and one-half acres at a cost of $21. In this latter case the plot was near the middle of the field (and there are many similar ones elsewhere) and could not be plowed; in this condition it was a hinderance to the proper farming of the rest of the field and an eye sore generally; it has this season produced its first crops of corn which will more than repay the cost of drainage, and its production probably did not cost five dollars more than if it had remained idle as formerly In the above case the question of profit is very easily answered, but this case does not govern others for the amount of ground drained in proportion to the length of its one drain was very great.

John Johnson, the veteran New York farmer, is quoted as saying, "Tile draining pays for itself in two seasons, sometimes in one." Thus in 1847 he bought a piece of ten acres to get an outlet for drains. It was a perfect quagmire, covered with coarse, aquatic grasses, and so unfruitful that it would not give back the seed sown upon it. In 1848 a crop of corn was taken from it which was measured and found to be eighty bushels per acre, and as because of the Irish farmer, corn was worth $1 per bushel that year, this crop paid not only all the expenses of draining, but the first cost of the land as well. Another adjoining tract was served in the same way, and by expending $30 per acre, Mr. Johnson obtained a crop of eighty-three bushels of corn per acre, for which the county society awarded the premium.

To put the question in another way. Many farmers have in some of their fields corners of an acre or more, which do not pay for the labor expended upon, and which they still farm with the rest of field because it is more convenient to do so. If they would count the cost of this work, they would see that draining would pay. The *Rural New Yorker* puts it in this way: Plowing, $3; seed, $2; harrowing, 75 cents; interest, taxes, &c.,

$5 25, and 25 bushels of wheat lost, $25, making a total of $36 per acre, which would have thoroughly drained the tract in two years.

Suppose the cost of draining to be $60 per acre; the interest upon this is $3 60; how great an increase in the crops will repay this and allow ten per cent. ($6 00) to go into a sinking fund for the re-payment of the principal? on this question Mechi writes thus in answer to queries as to profit: "On draining I have had to combat with great difference of opinion, and a great deal of prejudice, amounting in some instances to a disbelief of facts. Which is the cheapest drainage? It is cheaper than the shallow. I drained my clay actually 33 feet apart, 5 feet deep with one inch pipes. The cost of this was $16 per acre. I have reasons to believe that the interest thus will pay well, amount to at least from 50 to 60 per cent. in their investment annually."

As a general rule I find that ordinary workmen do not seem to realize the importance (to themselves if working by the rod or to their employers if by the day) of digging the ditches as narrow as possible. My average workmen seem to think that they cannot sink a four foot ditch on ordinary ground if it is less than two foot wide on top and eight inches on the bottom, making an average of sixteen inches involving the removal of three and one half cubic yards of earth to each rod of ditch, but I had on one occasion a man who opened such ditches with a near width of thirteen inches (twenty-one at top and five at bottom) and by so doing handled only two and an half cubic yards of earth to the rod of ditch, a saving of nearly one-third; he was working by the rod and I only claimed a "good bottom wide enough for the tile," and he was sharp enough to remove as little earth as possible. In practice I always find it best to allow a man to work to whatever width he has been accustomed and only mention this item to show the great importance to "work close."

Realizing the fact that the job is intended to last us as long as possible and that the greatest proportion of the expenses is in digging and filling the ditch, I have made use of tile, but this essay would not be complete without some reference to other kinds of drains and other forms of tile than the one previously alluded to, but allusions which I may thus make I do not wish the reader to construe into an endorsement of them, for if there is any one fact that has been thoroughly established by my experience and observation, it has been that it is poor economy to use second class material and expect a first class job.

Perhaps the most primitive mode practiced anywhere is that known as plug drainage in which the material removed from the ditch is used to form the drain and is only applicable to tenacious soils. A flexible chain of wooden plugs the size of the unbended drain is placed in the trench, and the earth returned and beaten down solid; the chain of plugs which should

not be more than five or six feet long, is then moved forward with a rope and lever and the operation repeated until the ditch is finished; of course this is not practicable for shallow trenches when danger is to be apprehended from frost. The expense of ramming and moving the plugs is fully equal to the cost of tile, and at best is but a make-shift plan when tile or stone cannot be obtained. Two inch tile at even forty dollars per thousand would make a more economical job. A similar plan, at least in its results, is that of mole draining as practiced in some of our Western States, but its redeeming feature is that while almost as reliable it costs is very much less. A plow with a long narrow cutter or share ending in a round bar the size of the intended drain, is run so as to keep its plug or bar in the proper position as to fall; the earth closing up fills the slight cut made by the perpendicular cutter but leaves the track of the mole open. The advantages claimed are cheapness and adapted to districts where there are but few stones and tile cannot be procured except at too great cost. In some of the more tenacious English clay drains are found by leaving shoulders near the bottom of the trench and covering with a stone or even an inverted piece of turf or sod; the objections are so evident as to not need pointing out. In many portions of Maine and Northern New England pole drains are constructed and are found to be effective if deeply laid, for many years. Two poles are laid side by side into a small space between them which is covered by a thin soil laid on top; some protection in the form of sods, brush or leaves must be placed on top of the poles before the earth is thrown in. Of stone drains we have many forms and styles of which but two seem to have any general success; one of these, probably the most common, an outlet for the water is secured by filling the ditch to within fifteen to sixteen inches of the top with small or broken stones loosely thrown in. The other plan provides for a continuous open channel by placing stones on such sides and covering them with flat ones. Of the two the former is probably the safest and best, because it is not liable to being stopped by the water undermining its side, but the comparative economy of the two methods will depend very much on the kind of stone and the amount of hauling. One who has practical experience (both as to cost and danger) in draining with loose stones furnishes me with the following items of cost for ten rods of ditch. Picking and hauling twenty loads of stone (from the farm,) $5 00, breaking and placing stone, $2 50, digging and filling ditch, $6 00, making a total of $13 50 or $1 35 per rod. If his estimates are correct, and I am right in estimating the cost of draining with tile at no more than 75 cents per rod, certainly the latter are the most economical. In the estimate of the stone drain, the convenience of getting rid of the stone from the fields is not counted, and is supposed to be counter-balanced by the trouble of removing the surplus earth after the drain is filled.

In some sections sawed boards are formed into a square tube with an orifice of at least sixteen square inches, if enough water is present to keep it constantly wet and good sound wood is made use of, this form of drain will last as long as one generation, but it is too expensive when tile can readily be procured, the boards should not be less than one inch thick and four or five wide, and it will require four to form the tube; in most cases the timber alone will cost twice as much as tile. In my case the boards would cost about sixty cents per rod of drain, while the two inch tile cost a trifle less than twenty-five cents per rod.

In all cases where this kind of drain is used, it should be with one of the *corners* in the *bottom* of the drain, so that it will concentrate the water into a narrow and deep channel instead of spreading it over the whole board; in several cases which have come under my notice, drains which would invariably choke up when the boxes were laid flat on the bottom of the ditch, would keep themselves clear when turned half way around or with the corners down.

To sum up and lay down the nearest possible to a universal rule as the result of my experience, observation and reading, I would say have the ditches as nearly to three feet deep as the fall will permit, use tile only, and none less than two inches, have the digging and filling done by the rod if a fair bargain can be made, but *always* lay and cover the tile yourself or employ a trusty hand *by the day*; have the drains two rods apart, if three feet deep, and if deeper, add two feet in width for each inch of increase in depth, carefully protect the outlet from all obstructions, and look for your remuneration in the increased crops, which must follow such a job when well done. Use all due and fair economy, remembering that in this work there is a possibility of devoting so much attention to saving at the spiggot as to neglect the bung-hole.

ESSAYS.

BY JOHN I. CARTER,
Superintendent Eastern Experimental Farm, Chester county.

HOW TO ESTIMATE THE VALUE OF FERTILIZERS.

I am frequently written to and asked what fertilizers farmers should use? Perhaps a public reply may be of some service to farmers; at any rate may save me some correspondence.

A farmer about to purchase fertilizers, should settle, as far as possible, what particular kind of fertilizing ingredient his soil needs. If it needs potash, then purchase those kinds containing largely of that material. If it needs nitrogen, and his barnyard cannot supply it, or it does not suit to grow and plow down clover, then he must purchase Peruvian or fish guano, or the commercial nitrates, etc. If his soil needs largely of phosphoric acid, then he must supply it from bone dissolved or undissolved, or from dissolved South Carolina rock. The soils of our section need replenishing with phosphate of lime more than any other inorganic substance, and hence our farmers are making more inquiry about phosphatic manures than any other kind. I propose to give a few brief directions how farmers may determine which of the many different brands of these commercial fertilizers to buy.

In the first place, it is safer, as well as more satisfactory every way, to deal only with reliable and responsible dealers. Then buy no article without a guaranteed analysis, or its equivalent. Our very excellent county law gives great security to purchasers of fertilizers. Manufacturers have not only to state the *amount* of valuable ingredients their goods contain, but are seriously responsible for any discrepencies. It takes only a few dollars to obtain a reliable analysis, and thus test their honesty. These circumstances have had a great effect in improving the character of the fertilizers offered for sale. It is no longer safe, or profitable, to offer a spurious or inferior article. The *price* has also been greatly reduced by the co-operative efforts of the Patrons of Husbandry. It is encouraging to notice that farmers now buy with greater care and intelligence; and to aid them in this direction, I will give a few rules for computing the value of fertilizers. These, though not entirely correct under all circumstances, are sufficiently so for practical purposes. It must be borne in mind that ammonia, phosphoric acid and potash are the only constituents in fertilizers, costing $15 or upwards per ton, that are usually taken into account. The price

per pound at which each of these shall be rated, must be found from the lowest market rates of the commercial substance containing them. Sulphate of ammonia, which sells at 5½ cents per pound, is perhaps the most known, and cheapest source of ammonia; although there is little difference in the cost of the ammonia in nitrate of soda at 3¾ cents per pound. Sulphate of ammonia contains from 25 to 30 per cent. of ammonia, hence 25 pounds of ammonia in 100 pounds of sulphate of ammonia, costs $5 50, or 22 cents per pound.

Phosphoric acid is cheapest when derived from phosphatic guanos, or mineral phosphates. Some of these guaranteed to show 10 or 11 per cent. can be bought for about $25 per ton. A ton then contains 200 or 220 pounds of phosphoric acid. This at $25 gives the value of 1 pound as 12 cents. Reverted or precipitated phosphoric acid is considered a little less valuable say 8 cents per pound. Phosphoric acid, in its insoluble form, as in animal bones, is rated from the cost of bone-dust. Bone-dust containing 29 per cent, of phosphoric acid, and 2 per cent. of ammonia, can be bought for $35 per ton. The 2 per cent. of ammonia gives 40 pounds in a ton, which at 15 cents, (its value when in its original elements,) makes the value of the ammonia in a ton to be $6, leaving the phosphoric acid in the ton to be $29, or 5 cents a pound.

Potash is cheapest in the form of muriate of potash, costing 2¾ cents per pound. This salt should give 50 per cent. of potash, or 1 pound of potash is worth 5½ cents. Now we have this table:

Available ammonia per pound	22	cents.
Ammonia in its original elements per pound	15	"
Soluble phosphoric acid	12	"
Reverted phosphoric acid	8	"
Insoluble phosphoric acid	5	"
Potash	5½	"

Now take the analysis of any fertilizers, multiply the per cent. of any valuable constituent by 20, which will give the number of pounds in a ton and that again by the price above given, and you can come pretty near its real value.

ABOUT OATS.

IS THE OAT CROP MORE IMPOVERISHING TO THE SOIL THAN ANY OTHER CEREAL?

If I confine myself to the text, my answer to this question will be brief. There is a kind of tradition among farmers, that oats poisons the ground, but I never saw any foundation for this belief. It may have grown out of two circumstances—first that oats straw is poisonous to the hands; and liable to make pigs mangy, when bedded with it—and secondly it is usually

grown after an exhaustive crop, and with no special manuring which very naturally would leave the land the poorer for the cropping.

Barley is perhaps almost the only cereal that you can fairly compare with oats; as the incidents of the planting and harvesting of the others differ so much that their effects upon the succeeding crops, would vary for other reasons, that from all impoverishment of the soil. We have some experiments, showing the comparative effects upon succeeding crops of growing oats and barley, which I will relate.

The plots experimented upon contained one-eighth of an acre and were farmed in the usual way.

Plot No. 1. Wheat after barley made of grain..... 64 lbs.
Plot No. 2. Wheat after oats made of grain..... 79½ lbs.
No. 1. Grass ofter wheat following barley..... 450 lbs.
No. 2. Grass after wheat following oats..... 490 lbs.
The same plots in grass the second year,
No. 1. After barley made..... 360 lbs.
No. 2. After oats made..... 380 lbs.

Hungarian comes next after barley in similarity of cropping, but I have no figures to show a comparison between Hungarian and oats on the succeeding crops. Appearances however have been much against the Hungarian. The wheat last year, was certainly poorer where the Hungarian had been cut, than where we took off oats, with the same amount of manure, used in both cases, previous to seeding to wheat, with this difference however, that it was applied before the Hungarian was grown, and after the oats.

The appearance is true of the present crop of wheat. This is as far as I can go in a strict answer to the question, and can only add by way of comment—that I think farmers should not be too hasty in discarding entirely, this time-honored crop. First because there are few others that seem to suit so well as a preceding crop for wheat and grass. The time of seeding and harvesting suits—and certainly no other crop leaves the ground in better condition, mechanically than this, and secondly, the grain is really valuable, and mostly grown with little cost. We give the crop little attention, plowing roughly and seeding hastily, with no special manure, and often harvest a good crop with little labor.

We this year harvested nine varieties of oats, that average 45½ bushels per acre, threshed out of the field and weighed. In looking over agricultural reports I find the net profits of the oat crop averages better than barley and pretty well up to wheat and potatoes—ranging from $15 to $30 profit, with a cost of $10 to $20 for seeding and expense. I might further add, that if we fed oats on the farm to our young stock, stocks, &c., we

would find it (judging from its analysis) to make a valuable addition to our manure pile.

In a table showing the amount of mineral ash contained in oats as compared with wheat, barley and corn, are the following figures. Of ash consisting of silica, phosphate of lime, magnesia, and soluble salts of potash and soda:

Wheat contains	3.02
Rye contains	2.60
Barley contains	3.10
Corn contains	1.25
Oats contains	3.25

showing that oats are richer in valuable earth ash than either of the other cereals—and consequently making it valuable when returned as manure. This hypothesis is demonstrated in another table, giving the estimated value of manure, from some of the feeding grains, as follows:

Manure made from wheat, value per ton	$7 96
Manure made from corn, value per ton	7 60
Manure made from barley, value per ton	7 12
Manure made from oats, value per ton	8 32
Manure made from oats straw, value per ton	3 24
Manure made from wheat straw, value per ton	3 00
Manure made from barley, value per ton	2 52

In still another table we have a comparison of its flesh producing and fat-forming principles, as follows:

Indian corn, flesh forming principle	$15 19
Indian corn, fat producing principle	5 94
Barley, flesh forming principle	6 10
Rye, flesh forming principle	16 00
Oats, flesh forming principle	18 44
Oats, fat producing principle	8 17
Cultivated grass, flesh forming	10 34
Cultivated grass, fat producing	2 51

From these data we are led to these conclusions: That the oat crop is not more impovershing to the soil than other crops, that it is reasonably profitable if given special attention. That as a rotation its place cannot be well supplied. That as a feed for working and young stock it has no equal and that its consumption on the farm makes a valuable addition to our manure pile.

EASTERN EXPERIMENTAL FARM.

March 30, 1876.

The meeting was called to order by the President, N. J. Sharpless, at the usual time. The secretary then read a report on an experiment with feeding oats straw to milch cows as follows:

OATS STRAW.

March 18th, we began giving a common cow (selected on account of being a ravenous eater) as much oats straw as she would eat, in addition to her usual feed of cut fodder, nay and meal. The first few feeds she ate ravenously of the straw, but settled to three or four pounds at a feed.

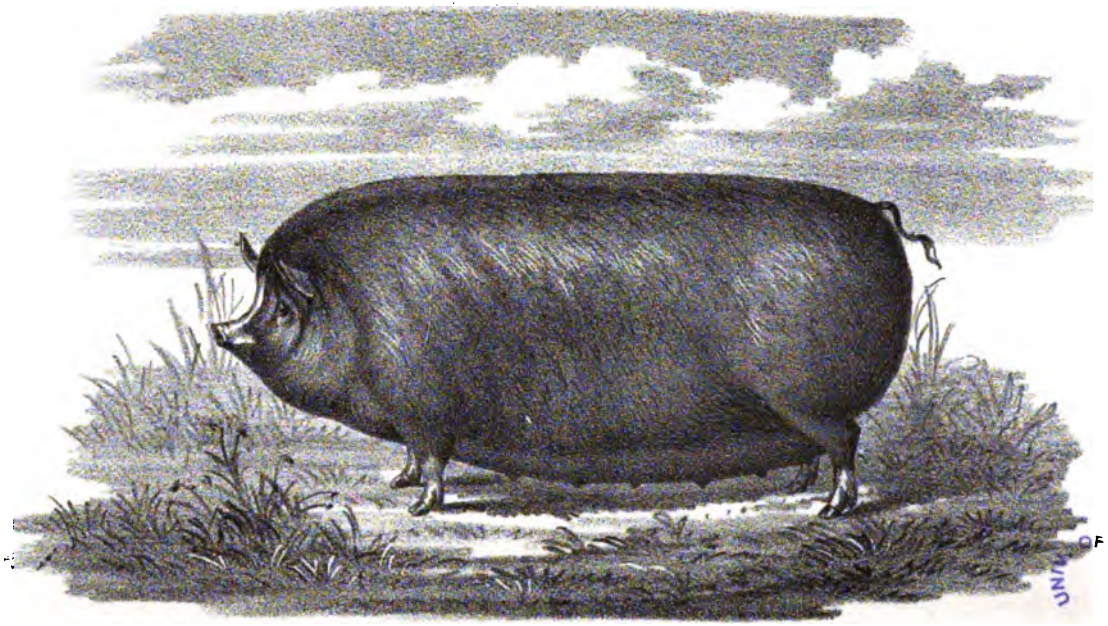
March 19th, we began weighing her milk, and found that eight milkings made 94 pounds of milk, or an average of 23 pounds 8 ounces per day. We then ceased feeding her the oats straw, and put her on her usual feed. We found six milkings made 77 pounds 1 ounce, or an average of 25 pounds 10 ounces per day. The whole experiment resulted as follows: 94 pounds of milk made 8 pounds 5 ounces of cream and 2 pounds 14½ ounces of butter; taking 32 pounds of milk to make 1 pound of butter. 77 pounds 1 ounce of milk make 7 pounds 5 ounces of cream, and 2 pounds 14 ounces of butter, and took 26¾ pounds of milk to make 1 pound of butter. This showing would indicate that the oats straw had been a serious injury; but during this part of the freezing the weather was quite cold and stormy and all the cows shrunk in their milk. How much of the deficiency was due to this cause I cannot tell. I would feel better satisfied to try the experiment again when the weather becomes settled, and perhaps try the whole herd.

Thos. M. Harvey said his neighbors, Isaac Daner and Enos Bernard, both reported that their butter was injured by feeding oats straw.

The secretary then read the following experimental test of Hardin's Refrigerator, ordered by the club:

HARDEN'S SYSTEM OF DEEP CANS, AND THE SHALLOW PAN SYSTEM.

We failed to receive Mr. Hardin's refrigerator until last Friday, the 24th, although it had been shipped on the 2d inst. We began to use it on the 25th, mixing and weighing the milk, and dividing into equal portions. One part set in three pans at a depth of about four inches, and kept in a room with the temperature as near sixty degrees as possible, varying from fifty-eight to sixty-two, and skimmed in forty-eight hours. The other portion was put in a tightly covered can, at a depth of twelve to seventeen inches—not milk enough to fill full—temperature of milk when put in the



Imported Berkshire Sow **SALLIE VII.'s DAUGHTER**
Property of T. S. Cooper, Coopersburg, Pa.

refrigerator was about eighty-five degrees. The temperature in the refrigerator stood at forty-three to forty-five, except for a few hours after putting in a new supply of milk, when it would run up to forty-nine and fifty. This milk was usually skimmed at forty-eight hours; but both lots were skimmed at the end of thirty-six hours this morning, in order to enlarge our churning. The cream from the deep cans was slightly soured by the addition of a little thick milk. The cream in both cases kept at a temperature of fifty-two degrees; but at the churning the cream from the shallow pans was raised to fifty-five, and from the deep cans to fifty-four degrees. It was intended to have both alike, of course, but the last skimming of cool cream made the difference.

The following is a record of the milking after dividing:

	lbs.	oz.
25th, morning	19	11
25th, evening	18	4
26th, morning	25	12
26th, evening	22	8
27th, morning	12	8
27th, evening	24	12
28th, morning	22	4
28th, evening	27	00
	172	11

The cream was churned this morning, resulting as follows:

Deep cans—weight of cream, twenty-six pounds eight ounces; butter, eight pounds one ounce. Shallow pans—weight of cream, fourteen pounds twelve ounces; butter, six pounds thirteen ounces.

The cream from the shallow pans churned in twenty minutes; from the others, in fifty minutes, owing, no doubt, to the increased quantity of cream and lower temperature.

From this showing it appears that it took 25.37 pounds of milk to make a pound of butter, from the shallow pans, and 21.41 pounds from the deep cans.

Thos. M. Harvey said he hoped the club would not endorse Hardin's system too hastily. The above detailed trial was a very short one, and necessarily imperfect. The questions involved were very serious, and important, and we should be careful not to mislead any one. Superintendent Carter said that although the experiment had been carefully conducted, yet as the whole system was new to him, he felt great delicacy in reporting this experiment, for fear something might be wrong about it. He asked that a committee might be appointed to assist in future experiments,

and suggest various points of test, such as the keeping quality of the butter, proper temperature, etc.

The club then appointed the following committee of advice: Thos. M. Harvey, Howard Preston, Thos. Gawthrop and John I. Carter, said committee to make monthly reports of their progress in experimenting.

Samples of butter made with and without oats straw, and others made with Mr. Hardin's process, and with shallow pans, were placed on exhibition. The butter made from deep cans was decided to be the sweetest and best. A specimen of skim milk was also shown—milk that had stood 48 hours in Hardin's box, and been skimmed, and was excellent drinking.

KEEPING THE BOYS ON THE FARM.

Charles Hambleton then answered his question, what kind of education should we give our boys, that will keep them on the farm? The speaker urged that for this purpose we should make home pleasant; give them good educations; furnish good books; see that they had good neighborhood society; that public opinion should recognize the honorableness of labor.

N. J. Sharpless said we should not bear on the grindstone too hard when our boys are turning.

Chandler Darlington said, give the boys the best possible chance, and then let them do as they please.

SOFT BUTTER.

George Sharpless answered his question, why is summer butter softer, at the same temperature, than winter butter? He said he supposed it was largely due to the fact that in winter the feed was harder and dryer.

Thos. J. Edge said he thought it was because summer butter contained 60 per cent. of oil, and 40 per cent. of solid matter. In winter it was reversed, and the butter contained 40 per cent. of oil, and 60 per cent. of solid matter.

Thos. J. Edge then answered his question, "Is a knowledge of agricultural chemistry any benefit or advantage to a farmer, in conducting the business of his farm?" He said the analysis of soils and manures oftener deceived farmers than benefited them; that many fertilizers which made a good showing when analyzed, were comparatively worthless, because the valuable ingredients were not soluble by the common solvents in the soil, though freely so when treated with chemicals in the laboratory. He cited the case of leather scraps, which, when chemically treated, showed 14 per cent. of nitrogen, yet owing to the tight hold of the tanic acid upon it, was practically valueless.

GRAIN AND GRASS SEED.

Thos. Wood read an essay in answer to the question, "What is the proper quantity of grain and grass seed?" He first spoke of the importance of well-developed and clean seed; then gave interesting calculations as to the number of grains in a bushel of the various seeds, and the space occupied by them. He argued that on fertile and well-prepared ground, each plant should have plenty of room to stool and develop. The best wheat crop he ever raised was from one bushel sowing. He gave us a rule —two bushels wheat; two and a half bushels oats; clover eight quarts, and timothy four to six quarts. Corn should be planted in rows four feet apart, and one stalk every foot.

IMPROVEMENT OF SOILS.

Mahlon G. Brosius read an essay on the improvement of our soils—suggesting greater attention to the manure pile, and the judicious application of bone and bone fertilizers. His essay was well written and interesting.

MISCELLANEOUS.

Simpson Preston read an essay on the subject of increasing the dairy and stock feeding department of our farms.

Thos. M. Harvey read a very able and valuable lecture by Doctor Michener, of Bucks county, on the ox's stomach, describing the organs and their functions.

FUTURE TOPICS.

The following questions were then referred for answer at our next meeting: Is the record of an instrument, the action of which depends on specific gravity, a safe test of the purity of milk? to Thos. Gawthrop. Is there any advantage in planting potatoes in hills? to C. C. Hood. What is the best system of training and pruning grapes for profit? to M. S. Cook. What variety of apples, pears, peaches, cherries and varieties of small fruits are most profitable in this section? It is desired that a list be authorized, called the Eastern Pennsylvania farm club list, containing 6 apples, 4 pears, 3 cherries, 4 peaches and 3 each of small fruits—each member to furnish a list. Thos. Edge was appointed essayist for next meeting.

J. I. CARTER,
Secretary.

WEST GROVE, *April* 27, 1876.

The Experimental farm club met at 1½ P. M. with President Sharpless in the chair. Attendance smaller than usual, owing doubtless to the desire of farmers to improve so fine a spring day in their fields. The minutes of the March meeting were read by Secretary Carter. Lewis S. Hough and Henry Rakestraw were elected to membership. The secretary read a re-

port of Eastburn Reeder, of Bucks county, detailing an experiment in butter making from milk set in deep and shallow pans, showing but little difference. The milk set in the deep cans was covered tightly whilst the animal heat was yet in it; but the quality of the butter from this was equal to the old method.

The essayists and members to whom questions were referred were not present, Joshua Jefferis, of New Garden township, a successful and experienced apple grower was called upon to name a list of apples best suited to this locality for profitable marketing, Mr. Jefferis gave the following list prefacing with the remark that the Brandywine (a comparatively new variety) was the best apple he knew of and if he intended planting an orchard he would plant one-fourth of this variety. It is a red striped apple of excellent quality and a profitable marketing apple. The tree is a good grower, comes into bearing early and is very productive. Next to the Brandywine comes the Roman Stem. Mr. Jefferies gave the following list of apples for winter—Brandywine, Roman Stem, Smith's Cider, Strawberry, (there is also a summer Strawberry,) Krouser, Rosebud and Rawl's Janneting. Late fall apples, Woolman's Long; the Smoke House does not do well on light soil Summer apple, Townsend, in his opinion is superior to all others for profit. His soil is of a calcareous or light limestone character, situation a valley of moderate depth. The Baldwin apple does better with us in a valley where the cooler air of the night does not ripen it so soon as in high locations. Every farmer should study the character of his soil. During a visit in the fruit season to the neighborhood of Fair Hill Maryland. Mr. Jefferies visited orchards where the Northern Spy did splendidly, the trees being loaded with perfect apples; also the Bellfleur and Hayes or English redstreak. These varieties do best on heavy clay soils, in high situations. It is said to be one of the secrets of Mr. Jefferies' success in growing such fine apples is the continued enrichment of his orchard by the application of cartloads of sand, lime, rich earth and manure spread under the trees.

Thomas Wood favored some of the old varieties of apples. Having planted four orchards in his time he had not found the new varieties as profitable as the old kinds—the fancy varieties were fine enough, but in his experience he failed to get good crops from them. He thought it better to have Romanities to sell in the market at $1 75 per bushel in the spring than others that did not keep so well. Mr. Wood reported the following list of fruits: Summer apples—Early Harvest, Maiden blush; fall—Smokehouse; winter—Smith's Cider, Gray and Red Romanites and Pennock. Pears—Seckel, Flemish Beauty, Vicar of Winkfield, Winter Neilis. Cherries—Early Richmond, Bigarreau, Black Heart.

J. I. Carter reported the following list: Summer apples—Early Harvest, Jefferis, Maiden Blush (for late summer); Fall and Winter—Fallawater,

Hayes, Smith's Cider, Krauser. Pears—Bartlett, Seckel, Shelden, Early Catharine, Bloodgood, and Lawrence.

N. J. Sharpless' list embraced Early Harvest, Maiden Blush, Smokehouse and Fallawater apples; Bartlett, Beurre d'Anjou, Clapp's Favorite, Lawrence, Shelden, Seckel and Howell pears.

Dr. Michener feared the attempt to establish a list to govern planters in their selections would be a failure. The Fruit Growers' Society had endeavored to do it, but were not successful. The soils and situations were so various.

Prof. Peck knew of a pear tree near Bellefonte, Pa., which never failed to bear a full crop for over 60 years. The cause was the application of heavy doses of potash to the roots—the tree standing close to a place where ashes were leached for soap making. Fruit trees require potash, bone or phosphate to make them thrifty and fruitful, and able to resist disease and insect ravages.

S. Preston's pear trees had blighted and died within a few years. C. Darlington thought it unprofitable to grow fruit. Quoted experience of persons who had abundantly supplied the trees manurial food.

J. I. Carter stated that there was marketed from the Experimental farm last year $400 worth of pears from three acres. The trees had been treated liberally with muriate of potash and South Carolina rock phosphate. The application being made under the trees, the ground plowed and seeded to clover.

Dr. Michener alluded to pear trees budded on quince having shown much susceptibility to tree blight and were short lived. The trees are subject to separation transversely at the joint.

J. I. Carter favored the Telegraph and Clinton grapes; Thomas Edge, the Concord; N. J. Sharpless, the Diana; Geo. Sharpless, the Elsinberg. The Catawba only does well in sheltered places. Prof. Peck said that mildew, to which the Catawba was so subject, could be prevented by placing a board or two over the top of the trellis where the vine was closely trained.

The following strawberries were recommended as the best and most profitable varieties: N. J. Sharpless the Charles Downing and Triumph de Gand; J. I. Carter, the Jucunda (on rich soil,) Wilson and Charles Downing; H. L. Brinton, the Monarch of the West, Wilson's Seedling and Charles Downing. Prof. Peck recommending the planting of strawberries by farmers for the use of their families. The culture of this delicious fruit is very simple and they are very productive. N. J. Sharpless quoted Fuller's plan of cultivation of the strawberry. H. L. Brinton stated that the plan of cultivating for two years and allowing them to take care of themselves the third year among the grass and weeds had been practiced by some growers with profit—notably, I. F. Vanarsdale, of Zion, Md. The

berries were found quite as large and abundant the third year as when cultivated. A new bed should in the meantime be planted. L. S. Hough coincided in this plan—had them to do well the second and third year amongst grass.

At this point in the proceedings a recess was taken, during which the members witnessed the operations of Peck's bug exterminator, and his West Chester pruning shears, manufactured by Speakman, Miles & Co.,—also some potatoes—the Farmer's Glory exhibited by William Little, Penn Station; very productive, yielding 450 bushels per acre of good quality, resembling the White Peach Blow. Brownell's Nonsuch, exhibited by the President, N. J. Sharpless, resembling Early Rose, said to be nearly as early, of excellent quality and very much more productive.

The next proceeding was an essay by George Sharpless, defending the position that a knowledge of agricultural chemistry was of advantage to farmers. Thomas J. Edge gave a verbal account of his trip to California last summer, his visit to the Mariposa grove and the big trees. On the stage journey, they passed by a wheat field 12 miles long. Saw sugar pines ten feet in diameter and 250 feet high. Of the large trees, the wood of which closely resembled cedar, Mr. Edge measured one as high as he could reach, the total circumference being 106 feet and 325 feet high; 100 trees of this character in the grove, each one of which would make 25 miles of four-railed fence. The greatest diameter of the twin-brother tree is 63 feet. He rode on horseback through the hollow trunk of a fallen tree a distance of 100 feet. As to the age of the trees there was much conjecture, some scientists supposing them to be 4,000 years old. A section of one of them cut and sent to the Crystal Palace, London, showed 1,300 concentric rings, indicating that many years' growth. The bark of some was three feet thick. The trees have been so much injured with fire that the State of California has made an effort to protect them, by erecting the grove into a public park and placed watchmen in it.

Mr. Edge gave a graphic account of the grand mountain scenery, the variegated foliage, the wonderful cascades, deep gorges, towering mountains and sublime chasms. He alluded to the dash and daring of the stage drivers, who galloped their six-in-hand uncomfortably near sheer precipices 2,500 to 3,000 feet deep, with nothing but a linchpin between the human freight of the vehicle and eternity! It was enough to make the stoutest heart quake and the strongest nerves quiver—until one got used to it. But there were ladies of the party who at home were weak and effeminate, were here strong and courageous enough to ride a pony over the roughest of rough roads twenty miles per day. It was inspiriting and health-giving exercise—amid the grand scenery and bracing atmosphere. The valleys, scorched by the sunshine of seven months, yet afforded ample provender

in the dry and nutritious herbage for stock. A rain in summer is a rare exception. The inhabitants don't find any disadvantage in this and utterly ignore the wise man's maxim to take an umbrella when starting on a journey even in the light of a cloudless morning. Mr. E. and a party (a large party of editors, principally of agricultural papers, including a number of ladies,) enjoyed the trip greatly. They visited Salt Lake City and were well received and entertained by the Mormons. He gave some account of Brigham Young and the peculiar institution of that people, polygamy, closing with his convictions that it can never be broken up by armed interference on the part of the government, but will ultimately be rooted out by the advancement of Christian civilization in the territory.

Lewis S. Hough was appointed essayist, and the following questions were referred to be answered at the next meeting: Is there any advantage to be derived from cutting the blossoms from potatoes?—George Sharpless. What is the cause of pear tree blight and the remedy?—Dr. E. Michener. What proportion of the food of the working farmer should be meat, and what kind are the best?—H. L. Brinton.

May 27, 1876.

After the adoption of the minutes of last meeting, George Sharpless answered his question, Does the cutting off of the blossoms of potatoes advance the growth of the tuber? In his opinion it did not. The character of the plant, and its habit of growth, indicate such a conclusion. Potatoes are not prolific of blossoms—some varieties bearing none—and the tubers frequently well grown before blossoming at all. Therefore he believed the effect of taking off a few blossoms would be slight.

N. J. Sharpless cited Lubig's assertion that such cutting did damage the crop.

Chandler Darlington said that plants, reproduced by bulbs and tubers, were less dependent on blossoms or seeds for their health or vigor.

John I. Carter stated that many kinds of plants made better growths of root and wood, if not allowed to bloom or perfect seed; but did not think the effect of such a course on potatoes would be of any account.

The discussion then branched off on to the

PROPER TIME TO CUT HAY, CLOVER, ETC.

Milton Conrad stated that his neighbor, Mr. Whirry, once cut his clover before it came into bloom, and made what was apparently the nicest hay he ever saw! If there was no loss by early cutting, it was certainly an advantage to have the time of harvest lengthened by beginning early.

J. I. Carter stated that the risk of damage by long exposure in curing unripe grass, overbalanced all other advantages. Even in cornfodder, it

was found from long experience, that fodder cut quite ripe was generally better feed than if cut green—no doubt on account of the difficulty of curing it.

J. I. Carter then read a report he had made to the committee appointed to test Hardin's system of

BUTTER MAKING,

as follows:

Had made several tests during the last month; tests usually about as follows: Milk mixed and divided by weight, one-half put in covered cans, twenty inches deep, and put in refrigerator. The other half put in shallow pans, using four shallow pans for one deep can. The temperature in the refrigerator was maintained at about forty-four, except after putting in a fresh setting of milk, when the temperature would raise—perhaps to 50°. The temperature of the milk room was kept at 58° as near as possible. Sour milk was put in the shallow pans, and both lots skimmed in thirty-six hours. The difference in the yield of butter was sometimes in favor of one plan and sometimes of the other; only varying a few ounces. There was but little difference in the quality of the butter, though I have a slight preference for the butter made from sweet cream, it having less butter-milk taste. I have samples of both makes put up in pickle, to test the keeping quality of each. From experiments thus far, I think I can safely conclude on the following

POINTS:

1. That all the valuable cream will raise in deep cans.
2. That it will raise at a low temperature, say 44 degrees.
3. That tightly covering the milk in cans does not interfere with its yield or present quality.
4. That the quality of milk—after skimming—kept in the refrigerator is much the best.
5. The labor of handling the milk and skimming, etc., is fully one-half less when kept in the deep cans.
6. That the cost for the tinware is about one-half less for the deep cans.
7. That the cans occupy only about one-eighth the space of the shallow pans.
8. That the milk in the refrigerator is much less subject to taints, or atmospheric influences, likely to vary the quality of the butter.

There is one important question yet to be decided: The amount of ice likely to be needed during the hot weather. If this should prove to be serious, it may overbalance, in expense and trouble, many other advantages. This point I have left for further experiment, as well as tests of quality and handling of butter made at a very low temperature during hot

Jersey Cow NIOBE, 18 years Old.
Property of Samuel J Sharpless, Chester Co, Pa
1st Prize Centennial Exhibition of Philadelphia, 1876.

weather. There may be quite a showing in favor of the refrigerator butter under such circumstances.

J. I. Carter then read an account of

THE JERSEY COW,

Sea Gull, belonging to the Experimental Farm.

Sea Gull, No. 898, of A. J. H. R., was purchased of Charles L. Sharpless, of Philadelphia, for $500. Mr. Sharpless donated $200 of this sum to the farm. She was imported in 1868, at about four years of age. She is of solid fawn color, fine figure, and weighs to-day ten hundred and fifty-five pounds. She has made about twelve pounds of butter per week, but has now failed somewhat in her milking qualities, owing to a breaking down of her udder. She is very gentle, and an easy keeper. Within the last eight years she has had nine calves, five of which were heifers. The bull calves sold for $165, and estimating the value of the heifer calves by the price of those sold, we have an aggregate of $790 as the value of her calf product. She is yet in fine condition, and looks as though she might raise several calves yet. This account is given to show that it pays to keep good stock.

Lewis H. Hough then read a very interesting essay on

FORESTRY,

and the cultivation of trees generally. He said that as man was the highest type of the animal kingdom, the tree was the highest type of the vegetable kingdom. He spoke of the growing interest in this subject—that the attention of nations was called to it; that civilization went hand in hand with the raising of fruits, etc.

The essay was quite interesting, and led to a wide discussion of the subject.

In an answer to a question by a member, as to the cause of

FIRE-BLIGHT IN PEAR TREES,

it was stated that such a question was referred to Doctor Michener, who, owing to absence, failed to respond to-day.

J. I. Carter said the application of mineral fertilizers to fruit trees gave greater constitutional vigor, and enabled them to better withstand the blight and other diseases.

MISCELLANEOUS.

Thomas Wood was appointed essayist, and to Milton Conrad was referred the question: At what stage of its growth should we stop working corn? To J. I. Carter: Are there any advantages from cultivating corn, besides killing the weeds?

J. I. CARTER, *Sec'y.*

A regular meeting of the Experimental Farm Club was held at the farm near West Grove, Thursday last. The club was called to order by the president, N. J. Sharpless, and the minutes of the preceding meeting were read by the secretary, J. I. Carter, and approved.

Superintendent Carter read the following essay:

PROFITS OF RAISING CORN IN CHESTER COUNTY.

Many farmers do not appreciate the value of corn as a paying crop. I, therefore, wish to briefly call your attention to a few facts and figures. Our crop of corn on the farm this year was a good one, though not better than we have had some other seasons. Our main crop, I am confident, made over one hundred bushels to the acre—estimating 72 pounds of green corn to make 56 pounds of shelled corn. This field was a clover sod in good heart, and had 800 pounds of acidulated South Carolina Rock per acre on part, and part had 660 pounds of Philadelphia bone.

We had some plots that were accurately measured and the corn carefully weighed, and these I can speak positively about. I shall, therefore, refer to them to prove what I have to state. Some of these plots made 98 bushels per acre, with no fertilizer since seeding wheat three years previous. This corn was drawn in and shelled, and the shelled corn weighed in the grain, when it was found that 72 pounds of ears made 56 pounds—making $50 96 per acre of corn. An acre made 264 sheaves of fodder, which sold in the field at four cents per sheaf, or $10 56—making for the whole crop on an acre $61 52. These prices were only such as any farmer could have realized this season, and the amount raised per acre has often been exceeded, and is certainly within the reach of any good farmer owning natural corn land.

The expense for labor, seed, &c., is not far from twelve dollars per acre. This, of course, is exclusive of fertilizers, which, if judiciously selected, will not only increase the corn but show for several years. We have no other field crop that will make as good showing, or can be raised and marketed with as little expense.

Our plan of planting corn is to sow a good phosphatic manure on the sod early, plow shallow—say four or five inches—cultivate well, drill corn in rows four feet apart, and stalks from sixteen to twenty-four inches apart in the row, according to the strength of the ground. It should be well worked and kept clean, but neither the plowing or planting should be very early. Plow the first of May and plant the second week.

Moses Brinton inquired the comparative values of South Carolina rock and bone. Mr. Linville had grown better corn with South Carolina rock than bone. J. P. Ambler had tried rock and bone, and measured corn raised, and was of the opinion that neither of them had paid.

Howard Hoopes inquired the best means of destroying ants in corn. Mr. Linville said wood ashes mixed with common salt would usually be found effectual.

Eastburn Reeder, secretary of the Solesbury Farmers' Club, of Bucks county, read an essay on

DAIRY HOUSE VENTILATION.

Mr. Reeder referred to the old plan of making butter in farm house cellars, where the temperature frequently reached seventy degrees in summer and would fall to forty degrees in winter, and the frequent plan of keeping the milk pans in the kitchen exposed to the fumes of cooking, which contributed nothing to the sweetness of butter.

The essayist was of the opinion that milk should be kept at a uniform temperature of about sixty degrees, thinking it would secure as good a quality of butter in January as in June, or in other words, have June butter all the year round. Being about to erect a dairy house he had visited quite a number of prominent dairies and carefully observed the arrangement of each and the results obtained, and thus gained much valuable information. His plan adopted was to build an ice house and milk house combined, divided by an eighteen inch stone wall with a cooling chamber in it, with pipes arranged to admit the cold air into the milk room. He ventilated from the centre of the ceiling to carry off the light gases that arose, and by drain pipes below the level of the floor to carry off the foul matter that was heavier than air. A house twelve feet square and high constructed, on this plan would be sufficient for a dairy of twelve cows, and could be so shelved as to answer for fifty cows. The ice house adjoining should be the same size. It required from five to fifteen bushels of ice per week to keep the milk room at the proper temperature. He favored the use of shallow pans with the milk exposed to the air, and that it should be cooled gradually to exude the animal heat and animal odor. He had been very successful by this proces in obtaining a uniformly excellent quality of butter throughout the year.

Mr. Reeder was followed by an essay on the same subject by L. S. Hardin, of Kentucky, whose views were radically opposed to the theories just advanced. The following is an abstract of his remarks:

About four years ago I started a butter dairy near the city of Louisville, Kentucky; in a climate hot and humid, where animal substances decayed rapidly, and where insect and parasitic life developed spontaneously and without limit. To spread the milk out in the usual manner was to invite the enemy I was most anxious to avoid. To overcome my difficulties I began a series of experiments, beginning with shallow pans in the open air, and step by step I lowered the temperature and increased the depth of my milk, until I reached what is now called the Swedish plan of setting

milk in water at 40 degrees, with cans 20 inches deep. I found I had passed the profitable point, and had to retrace my steps until I decided upon 49 degrees as the best temperature for raising the cream perfectly, and made my cans 8 inches in diameter and 12 and 20 inches deep. My butter was now all I desired, but the use of ice in cooling water that was in immediate contact with the hot air was too expensive. I soon discovered that it took less ice to cool a given cube of air than it did to cool the same cube of water. It was equally evident that it was a useless waste of ice to cool off a whole room full of air, and reasoning from these premises I concluded to confine my milk and air to the smallest possible space in order to economize the use of ice. I then built a box with double sides and close fitting double door, putting a hood or trap over the waste water pipe so as to entirely exclude the surrounding atmosphere. As it is the nature of heated air to ascend, I placed the ice shelf in the top of the box to secure a uniform temperature. A space of one inch is left open on each side of the shelf to allow the air to pass around the ice. The drippings from the ice are utilized to the extent of four inches in the bottom of the box. The cans are made with a perforated rim on the bottom to allow the water to pass under them. The covers of the cans fit outside so as to shed the water and prevent any of the drippings getting in the milk.

It is only after three years' satisfactory experience and trial tests with the best butter makers in this country, that I have concluded to introduce this as an improved method of butter making. In order to criticise my method with intelligence, it is necessary to have before your minds all the points of excellence that are desirable in any system of butter making. To accomplish this I will submit to you a high and thorough standard by which I am willing to have my method tested. The taste of the butter produced; the aroma; the uniformity in quality; the color; the grain or texture; the quantity produced; the keeping quality; cost of making; the labor in making; cost of utensils; cost of buildings; protection of the milk from accidents; amount of skill required to make a fine article of butter, and the practicability of my method.

I have made two careful experiments in churning sweet and sour cream. As both experiments turned out exactly alike, one description will answer. I took fifty pounds of cream that was sweet and liquid, perfectly free from skins or lumps, stirred it thoroughly together, and while in motion dipped out one-half by weight and churned it immediately. Put sour milk in the other half and let it stand until thoroughly and sharply soured. Both batches churned at 63 degrees. Each of the four churnings came in twenty minutes. In each experiment the sweet cream produced five ounces the more butter. Every person who tested the samples while fresh, pronounced the sweet cream butter the better. After keeping the samples

several months, I am of the opinion that the sample from the sweet cream keeps the better.

Milk as it comes from the cow is a pure and perfect food. With my method I take it while in its pure condition and place it in an atmosphere so cold that decomposition is practically arrested, and hold it at this temperature until the cream has all arisen, about thirty-six hours. When I skim the cream it is liquid and sweet. The cream can, of course, be soured if desired. As to the taste of butter made by my process I have always received the top price of my market the year round.

Nine-tenths of the butter bought in market is judged by the sense of smell. If, in the course of manufacture, the light flavoring oils are exposed for a long time to the action of the atmosphere, they must in a measure disappear. By my process evaporation is practically arrested, and if the milk has come from the cow in a pure and wholesome condition the butter is certain to possess an exquisite aroma.

Setting milk in the dark does not seem to affect the butter one way or another. In making experiments, setting one-half the milk in the dark and one-half in the light, after twenty-four hours there was no difference in the color of the butter.

Too much heat is fatal to the grain of butter, and it requires a master spirit to preserve its fine waxy texture, with milk set in the open air and the thermometer indicating a tropical range of from 80 to 100 degrees.

In midsummer it required a fraction over nineteen pounds of milk to make a pound of butter with shallow pans, while a fraction over seventeen pounds was required in deep pans. When the milk and cream are allowed to sour together, as in shallow setting, and the souring process is still continued with the cream after it is taken off, there is great danger of a slight degree of decomposition taking place, which greatly injures the keeping quality of the butter. When the cream is taken off sweet and pure, and if churned while in this pure condition, the keeping quality of the butter is insured.

He showed at length that by his process the amount of skill and labor required was greatly reduced, and the cost of buildings and utensils largely decreased. He exhibited a model of his box and milk cans, the former of which he has patented.

Mr. Reeder maintained that if nothing was noticeable in the odor of the air of the milk room, that its effects could not be noticed in or tasted in the butter.

Mr. Hardin replied that it sowed the seeds of destruction in the milk which were developed in the butter.

Secretary Carter read an essay written by Prof. J. Wilkinson, of Baltimore, who was unable to be present, favoring the ventilation of milk rooms, as follows:

"We want the truth and the whole truth as far as we understand the science of butter making, and it is the height of folly for any one to attempt to promulgate any system or branch of a system of this immense native industry which cannot stand the test of dairy science, and the scrutiny of dairy chemists. I have previously advocated the importance of ventilation for dairy rooms, and opposed to cooling milk rapidly in the use of cold water instead of cool air, which latter plan I recommend.

I claim that ventilation, by which I mean a change of air in the dairy room with sufficient rapidity to prevent the possibility of the gaseous emanations while it is cooling, known in common parlance as animal odors, being absorbed by other milk, already cool, with which it may come in contact and thus secure the maintenance of the purest condition of the air of the dairy possible, an essentiality claimed by every dairyman in the world, save one or two. The most reliable dairy chemists have established the fact that milk gives off vapor and odor, which are known in dairy science as volatile animal oil, that is mingled with natural milk, and which escapes slowly at blood heat, more rapidly as the temperature is raised, more slowly as it is lowered until it reaches 62° when it remains fixed or unvolatile in the milk and cream. At a little below 60° it is condensed to a liquid oil. At the natural temperature of the milk the gaseous odors are given off slowly, hence time is required to admit of its purifying itself. It may however be greatly facilitated by artificial heating, which if the milk is to be suddenly cooled by a cold water bath, would greatly improve the keeping quality of the butter made from milk so cooled. But carefully conducted experiments in cooling the milk gradually in cool changing air, has proved that it is sufficiently purified to insure good preserving qualities and yet not impair its flavor.

It may be contended that milk, as it comes from the cow, is in a state to adapt it well as human food, but let us not lose sight of the fact that when thus used those properties which so impair the preserving qualities of the milk and butter are the active ones in rendering such fresh milk diet, whether of man or beast, readily and rapidly fermentable and assimilable qualities, the direct opposite of which is the aim of the manufacture of butter to be preserved. It is a well-known fact that milk that has been artificially heated up to 130° to 140° will remain sweet longer kept at the same temperature, than milk not so heated. By cooling milk in close cans, in the use of ice or cold water, we confine in it those agents of decay that heat is known to set free, and the keeping quality of the milk thus suddenly cooled must be proportionately impaired.

I am willing to stake my reputation as a dairy chemist and a dairy architect on the soundness of what I have stated. It may be denied, but it cannot be proved by practical test to be untrue.

I repeat we want truth. I also repeat what intelligent, skillful dairy practice has everywhere and at all times sustained, that the cream from milk that has been rapidly cooled in close vessels will not make butter of equal flavor and equal keeping qualities, that cream will from the same milk slowly cooled in pure, partially dried and suitably cooled changing air. I mean by suitably cooled air at the temperature of 60°F.

A vote of thanks of the club was extended to Messrs. Hardin and Reeder, for their presence and instruction.

BEE KEEPING FOR FARMERS.

Read before the Experimental Farmers' Club by Rev. Orr Lawson, February 24, 1876.

It is not to be expected that farmers will or can devote that time and attention to bee keeping necessary to become generally scientific apiarians. This must be left to men of leisure, whose tastes lead them that way, or to specialists who make bee keeping their business.

But at the same time, a wise husbanding of the resources of the farm seems to demand that each farmer should keep at least a few hives of bees. He may thus save a product of his fields which would otherwise be lost, and so add somewhat to the profit of the farm or to the comfort of his family. And this doubtless most farmers would do, were they not deterred by the disheartening failures which have so often overtaken their enterprises of this sort. It will be the object of this paper to give, if possible, some hints by which mistakes leading to failure and loss may be avoided.

Here let us observe, that bees, like everything else on the farm, requires some care and attention. If left entirely to "take care of themselves" they will as certainly fail as a field of corn or a herd of cattle, and yet on the other hand a few hives require comparatively little attention, and can be cared for in fragments of time which otherwise would hardly be put to any profitable use. In addition to this bees require *proper hives*. It is my opinion that more bees are lost from the use of hives of faulty construction than from all other causes combined. A hive to give the best results in *this climate*, and for wintering on their summer stands, (and for this region that is, I think, the best plan,) should be nearly cubical in form, having 1,800 to 2,000 cubic inches space in the main apartment; should be made of pine or some other soft wood not less than one inch in thickness—two inches would be better no doubt. Should be provided with movable comb frames, after the simplest arrangement, and space above for honey boxes,

the whole of the simplest possible construction, avoiding if possible all complicated arrangement of drawers, doors, moth traps, and the like. These only afford hiding places for moth and embarrass the bee keeper in his operations.

The hives should be placed not too near each other, and not more than six or eight inches from the ground. They are thus less exposed to the wind, are much warmer in the winter, and are much more easily reached by the bees as they come heavily laden from the fields. The hives should be located near where the family constantly pass. They will thus become accustomed to the presence of man, and ceasing to fear harm at his hands will cease to sting. This, with proper attention, will so "tame" them that, with care, all needful operations may be performed safely. Swarms from hives so treated rarely escape to the woods. They are no longer *wild bees*, but *domestic*, and look to man for shelter and care.

If possible the hives should be sheltered from the north winds by a fence; or better, by an evergreen hedge. They should be protected from the sun in mid-summer and mid-winter, but in the spring and fall the sun should shine full upon the hives.

Most bee keepers had best let them swarm naturally, because artificial swarming requires knowledge and skill, which but few attain, not because it is difficult to acquire, but because study and observation are necessary to acquire them.

Native bees have done as well for me as Italian. Under the same treatment I have observed no difference; however, many bee keepers greatly prefer them, and my experience may be exceptional. I think their introduction will be of advantage in securing a cross with the natives.

QUESTIONS AND ANSWERS.

How long do bees live?

Working bees live not more than four months in summer and not more than eight in winter. The queen lives three to four years.

How do you protect bees from the moth?

By so constructing hives as to afford no hiding place for moth, and by keeping the stacks always strong. Still we must not expect to escape loss sometimes.

How do you prevent swarming?

By giving them abundant space in which to work, remove honey boxes as soon as full and supply empty ones; thus they will swarm but little.

Mr. Hardin offered to furnish his dairy apparatus to the club or any dairyman for trial, and if it did not do all he claimed for it, after a fair trial, he would take it away at his own expense. The club accepted his proposition, and the process will be tested at the Experimental Farm as soon as practicable.

The regular monthly meeting of the club was held upon the lawn, the indoor accommodations being much too limited to accommodate the large number in attendance.

The meeting was called to order at 11 o'clock by Chandler Darlington, President, *pro tem.*

The Secretary read the minutes of the previous meeting, which were approved as read.

W. A. Fisher of Montgomery county, Chas. Ramsey and Enoch Harlan were duly elected members of the club.

John I. Carter, Corresponding Secretary, read a communication from Jonathan Rees, of Phœnixville, upon the subject of planting centennial trees upon the roadside or on the farm, and advocated an alphabetical system of names of trees that would spell or designate the name of the planter, or for whom planted. Dr. Michener and other members of the club thought the plan impracticable, as the nomenclature of trees change so often that in a few years all traces of the project would be entirely lost. W. A. Fisher suggested a more feasible plan, that is, to plant one or more centennial trees, name and number them, and make a note of them upon the margin or back of the deed of property by whom planted, and recorded as other instruments of writing.

The Secretary read a report of the committee relative to Dr. Hartman's proposition to donate his entomological cabinet, providing the club would pay for the cases, which would amount to about $42. The committee examined the cabinet and found it in such condition that it would not be of much value to our club, as the insects were not classified and in many respects incomplete, more especially the kind that interests the farmer. On motion it was voted that this club respectfully decline the proposition of Dr. Hartman for the reasons stated in the report of the committee, and that the Secretary be directed to notify Dr. H. of the result.

Nathan J. Sharpless moved that a committee be appointed to take measures to get up a cabinet, said the collection of such insects would interest the farmers in this region. Job H. Jackson, Edward Conard and Thomas Harvey were appointed a committee to make necessary arrangements, and desired every member to bring a bug or insect with them at the next meeting.

At this juncture the meeting adjourned till 1 o'clock. After the adjournment the rustic tables in different portions of the grounds were soon laid, and a finer repast was seldom presented to the whetted appetites of the large gathering of ladies and gents, and well they all did their duty to satiate the inward man. It would be impossible to enumerate the great variety of edibles. Suffice it to say the quality and quantity was most

creditable to the ladies who so generously provided the luxuries on this memorial occasion, and there were baskets full left.

At 1 o'clock the meeting was again called to order by the President, N. J. Sharpless, when Dr. E. Michener proceeded to read a very interesting essay upon the functions of the cow's stomach, its anatomy and physiological condition and action in relation to eating and drinking, etc. It was criticised somewhat by Simpson Preston and others, and remarks upon the subject were made by Dr. Gibson, John I. Carter, Dr. Eshelmore, George Sharpless and Thomas Wood.

Thomas Gawthrop replied to the question referred to him at a former meeting: "Whether a lactometer is a true test of pure milk? According to the lactometer, the density of pure milk was 82; after standing six hours and skimmed, it indicated a density of 100; twelve hours, 110. One-sixth of water added would reduce it twenty points below the standard of pure milk.

Marcellus Cook replied to the question referred to him, as to the "best system of grape culture." He would select as the best to cultivate in this region the Concord and Catawba, and would select such soil as would produce good corn as the best adapted to grape culture; would plant upon ordinarily high ground easterly, or to an easterly exposure. Grapes, he said, were good feeders, and therefore needed deep soils to produce well, and would recommend cutting back to first and second buds the first few years; had known of vines producing 1,000 pounds of grapes per acre with as little work as growing an acre of corn, and the grapes commanding at least six cents per pound, would yield an income of $600.

Prof. Heiges on account of his health, was not able to be present, but sent a paper which was read by the Secretary, upon the relation of temperature and depth in the formation of cream.

In the consideration of a subject in which similar results have been obtained by apparently antagonistic processes, an investigation of a few general principles of physical science may be profitable.

The great fault with many who are willing to impart information upon subjects of a practical nature is their want of time or appliances to thoroughly investigate the principles involved, and most frequently *facts* are taken as *laws*.

These are those who advocate the application of heat as the only means of separating cream from milk.

Here we have an example of a fact being stated as a law.

Heat will most successfully and thoroughly separate cream from milk, but not as it is generally applied.

The general plan is to heat the milk to a certain temperature as soon as possible, and to either cool it rapidly by artificial means, or to allow it to cool slowly by the natural process of radiation and convexion.

How widely different is either plan from nature's plan! In the separation of cream from milk by the natural process heat is *constantly* applied, from the moment of secretion in the udder or mammillary glands until the moment of entire separation.

This temperature varies in the different species of mammiferous animals, but we are not far wrong when we say that the best results from the application of heat would be secured by subjecting the milk to a temperature of 98 degrees, Fahrenheit, until the cream is entirely separated.

The thermometer applied to milk immediately upon drawing it from the udder will definitely fix the temperature for cows, goats, sheep, etc.

That nature adopts such a plan of separation is confirmed by the use of the lactometer, the last drawn milk frequently being from four hundred to five hundred per cent. richer in cream than the first drawn, the udder being but a membraneous or cellular vessel, taking the place of the milk-pot, in which the cream rises to the upper portion from its superior lightness.

It may not be amiss to state just here that this separation in the udder takes place that the young animal must partake of that portion of the milk containing the phosphatic salts and other substances so essential to building up its frame, and that the carbonaceous matter may be furnished when most the animal needs it.

We have no doubts that the best results from the application of heat would be obtained, not by a brief heating, but by maintaining the natural temperature of the milk for a period of several hours at least.

We do not say that the best possible results can be obtained, or that such results that could be obtained would cause the least trouble and attention.

It appears exceedingly contradictory that results similar to those obtained by heat may be obtained by cold, yet such are the facts and they admit of scientific explanation.

Heat is recognized as the only repulsive force in nature, *i. e.* as the temperature of a substance is raised its bulk increases. Whilst this is true generally the opposite is also true in a few instances, *i. e.* as the temperature is *lowered* the bulk increases.

Experiment upon experiment has established the fact that water is heaviest at 39.2 degrees F., or 7.2 degrees too warm for freezing, and as it lowers its temperature it increases its bulk and rises to the surface lighter, but sufficiently cold to freeze.

Here we have an example of cold producing the same results as heat upon other substances.

In a homogeneous liquid, like water, the surface particles radiate their heat, fall and rise successively; but in a heterogeneous liquid, like milk, those substances which most readily change their temperature, most readily fall or rise.

Now, it is established beyond the peradventure of a doubt that water is less susceptible to change of temperature through the addition or withdrawal of heat than any other known liquid, *i. e.*, that a given increment of heat effects a given bulk of water less than the same bulk of any other liquid; or, as it is familiarly stated, "water is heated with greater difficulty and retains its heat more closely than any other liquid."

The formation of cream is but the separation of the richer from the poorer and watery portion of the liquid.

Now, knowing that heat and cold both effect all other substances of milk more easily than the water of the milk, we are prepared to understand why either heat or cold may be employed as an agent of expansion upon the susceptible cream particles.

Permit me to illustrate: Conceive particles of milk and particles of cream lying upon the bottom of any vessel; they must all weigh the same or they would not sink to the same depth; heat or cold will cause the cream particles to expand more rapidly than the milk or water particles, i. e., they occupy a larger space than the latter, although they weigh the same, in the language of science, they become *specifically* lighter, and rises through the milk and water, as the inflated balloon rises through the heavier air.

It is evident that the greater the difference of bulk between the cream and poorer particles, the more readily will the former rise.

If we remember that water becomes heaviest at 39.2 deg. F., it is evident that a lower temperature will cause the particles of water to expand, rise to the surface, and commingle with the cream.

In all of my experiments I have obtained the best results at 40 deg. F.

We do not pretend to argue that if cold be a means of cream formation, the colder the better; for at a temperature of 32 deg. F. the water particles which have risen to the surface form ice to the great injury of the cream.

Finally, the relation of depth to temperature. In a milk-trough, the temperature of the water being 62 deg. F., the lactometer uniformly showed the best results when filled to the height of six inches. As the temperature of the water was artificially lowered, the depth of the milk could be increased until twenty-four inches were reached at a temperature of 40 deg. F.

We cannot increase the depth beyond that any more successfully than we can lower the temperature beyond 40 deg. F., although I can assign no reason for the former fact.

Possibly the pressure of the superincumbent column is too great upon the particles lying at a greater depth, so that the cream particles submit more readily to the pressure than the milk and water particles, and are less susceptible to expansion from a low degree of cold. A cubic foot of milk weighs about one thousand ounces. If this be placed in a vessel having a bottom surface of a square foot, there will be a pressure of about seven ounces to each square inch; if the column be two feet high, there will be a pressure of fourteen ounces per square inch, etc., etc.

If this pressure acted equally upon all the substances of a heterogeneous liquid, *i. e.*, if equal weights of the different substances maintained their same relative bulks when subjected to pressure resulting from different depths, temperature alone would be the modifying agent, but depth acts prejudicially beyond two feet, which, I repeat, results from some law which I confess I thus far have failed to comprehend. Owing to the fact that air can be more easily reduced to a temperature of 40 deg. F. than water, and that the particles of cream easily rise through a depth of two feet at this temperature, contrary to my previously formed opinions upon the subject, I freely admit that Hardin's method, or a modification of it, conforms more closely to establish physical laws than any other system with which I am familiar.

S. B. HEIGES.

York, Pa., *August* 31, 1876.

After the reading of the essay of Prof. Heiges, on motion it was voted that we have a recess of twenty minutes to examine some agricultural implements. After re-assembling, Dr. E. Michener proceeded to read a very instructive paper upon the coloring matter of butter. Besides his own views upon the subject, he referred to E. Ruder, Profs. Arnold and Hardin's ideas as to the saffronicious coloring of butter—that it was a substance peculiar to animal secretions and natural to the bovine race.

John I. Carter asked if our club was doing anything towards having a representative in the Board of Agriculture that was to be organized in January next. A law was passed last winter for such an organization, the object of which was to present to the farmers and those interested, reliable statistics, and for the promotion of agricultural interest.

Simpson Preston desired to know the kind of drill for sowing grain. John I. Carter had used Shimer's patent with good results, but found broad cast sowing the best.

Questions referred to be answered at the next meeting were:

Can any means be adopted that will enable farmers to raise plums profitably? Referred to Charles Ramsey.

Shall we sell our surplus feed or buy stock to feed it to? If to buy stock, what kind would be most likely to pay? To C. Hamilton.

What kind of stock should we keep to improve our farms most? To Thomas Wood.

Is diversity of crops advisable for the general farmer? Benj. Swayne.

Howard Preston was appointed essayist for the next meeting of the club.

July 27, 1876.

The meeting was called to order at the usual time, and the minutes read and approved.

The Secretary read a report on Mr. Hardin's refrigerator, and also a letter from Mr. Kokum, of the Swedish Centennial Commission, describing his method of managing milk to make butter. The Secretary further stated that Mr. Hardin desired the club to make some disposition of his box, whereupon Thos. J. Edge offering to take the box off our hands, a motion was carried disposing of it in that way.

Doctor Michener then made a report upon an experiment made by him on planting diseased potato tubers, showing that the fungus was readily transmitted to the new potato. A letter was then read from Doctor Hartman, of West Chester, offering his very fine collection of insects, &c., to our club, if we would re-imburse him for the cost of boxes containing them —13 boxes at $2 50 each. Thos. M. Harvey spoke of the value such a collection might be if properly arranged, and a suitable place found for their display—that many farmers failed to recognize their friends from their foes in the insect world—and such a collection here might be made to throw light on the subject.

Lloyd Balderson approved of Thos.' remarks, and moved that a committee be appointed to examine the collection and report on the advisability of accepting the Doctor's very handsome offer. The committee appointed stands: Lloyd Balderson, Thos. M. Harvey and Everard Conard.

Doctor Frank Taylor, of Kennett Square, then addressed the club on retrospective and prospective agriculture, and entertained the club in a very satisfactory manner.

R. L. Wood then read an essay by Thomas Wood, in which he discussed the monetary questions of the day, tariffs, and other kindred topics.

Thomas' essay led to considerable discussion on the various points raised in it, participated in by Doctor Houston, Chandler Darlington, Jos. C. Turner, Prof. Heiges, Jacob T. Stern and others.

In answer to a question as to the best variety of wheat to sow, several farmers gave their experiences, some spoke strongly of the Clawson. B. L. Wood stated that he had raised 100 bushels from 2½ acres. The Fultz, however, was most generally commended on account of good yield and earliness.

On motion of Doctor Michener the club adjourned to meet at 10 o'clock on next meeting day, the farmers and their families to bring baskets, in picnic style.

Doctor Michener was appointed essayist.

Prof. Heiges kindly consented to lecture at our next meeting on the relation of depth and temperature to the raising of cream.

Joshua Jeffries, B. L. Wood, Thos. Gawthrop, N. S. Cook, C. C. Hood and other delinquents were continued to report and answer.

J. I. CARTER,
Secretary.

September 9, 28, 1876.

The president called the meeting to order at the usual time, when the minutes were read and approved. The secretary read a call for a trial of pruning shears, to be held at ten o'clock A. M., on our next club day, under the charge of our implement committee.

Benjamin Swayne then answered his question as to the advisability of variety in farming, which he strongly advocated. His plan was to work two or three acres in truck—vegetables and small fruit—could raise four or five hundred dollars worth without much additional help.

Milton Conrad spoke of the advantages of a diversity of crops, not so likely to meet with entire failures, more likely to improve the farmers, and the general intelligence of the farmers.

J. I. Carter thought a concentration of capital and effort in some particular line or branch of agriculture would be more likely to secure its being well and profitably done.

Howard Preston and Chandler Darlington took this view.

Mr. Hough, N. J. Sharpless and Thos. J. Edge spoke on the question.

Howard Preston then read an essay on "The best plan to keep our boys on the farm."

The essayist spoke of the various causes which led to a distaste among farmers' sons to the life of the farmer. They experienced so much hard work and heard so much of the stereotyped complaints of their parents about their business, that other trades and occupations looked tempting beside theirs. Homes were not made pleasant enough, nor the children interested sufficiently by pecuniary participation. The essay was well received and led to considerable discussion.

Chas. Ramsey then answered his question, "Whether plums could be successfully raised in this country?" This he answered very fully in the affirmative, citing numerous instances of success; advised good ground, low situations, fighting the curculio, and a wash made by adding one peck salt, one bushel lime to six gallons of water.

Milton Conard had secured a crop of green gage by using a solution of carbolic acid, (two hundred parts water to one part of acid,) applying it to the trees with one of Peck's Atomizers.

M. S. Cook said, the severe cold of two winters ago, killed many bugs and insects, and the trees had since been freer from their attacks.

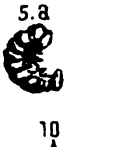
Chandler Darlington was appointed essayist.

The old questions continued.

Larva of a species of Lyda. redish olive, green, head pale - redish ——

Pupa of a Rubber Fly

Pupa of Horse-Fly

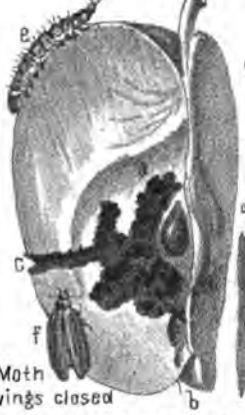


Description
A section of an Apple
b The point where the egg is laid

3 The Insect or Moth with its wings spread,

color light brown - the fore wings dark brown along the inner margin, tinged with gray with a spot near each angle and other spots and streaks

Notodonta Concinna



g The Moth, wings spread

d The Chrysalis in 14-17 days

The Moth wings closed

c The channel of escape in 32 - 36 days

e The worm or Caterpillar

i The Cocoon in its shelter

1 Shows the Caterpillars on a denuded leaf stalk

2 A full (rather over the natural size) grown Caterpillar a. The bright red head b The red hump on the joint

Red hump Caterpillar

ROGUES' GALLERY OF INJURIOUS INSECTS.

A good microscope or ordinary pocket magnifying glass, used to inspect small insects, will reveal their form—by having seen an illustration we at once recognize the creature, and thus gain a knowledge and a name that, by research in books on the subject, we may derive the full account so far as known, and by observation add to the general fund of information.

NOTES ON FIGURES.

Figure 1. 1*a*. show the *larvæ* of the saw flies. The genus, *Lyda* and *Cephus*, have no intermediate prop-legs as the other genera have. These belong to the HYMENOPTERA.

Figure 2. The robber-fly, *(Proctacanthus Philadelphicus,)* bury in the sand, like the large horse-fly. Fig. 3. *Tabanus atratus*, these also live in garden mould, and belong to DIPTERA. Fig. 4. A species of Plant louse, the *alcurodes vaporasium*. 4*a*, is the pupa. These, like the mealy bug, and Fig. 7, the *Lecanium filicum*, and 7*a* underside. Fig. 8, *Lecanium platyceru*, resembles the plant house *cocus adonidum*. This gives an idea of the scale insect, &c., infesting plants—when magnified.

Fig. 5. One of the Elbo-antennæ Snout Beetles, like the grain weevil. Fig. 6, the bean weevil, 6*a* the pupa of a Bruchus. The bean shows a number of grubs in it; differs from the pea Bruchus. Fig. 10 is the corn Sphenophorus, the *S. Zeæ* of Walsh. These infest the Indian corn. Fig. 5 is the cranberry weevil and larvæ. Those that feed on our currants are the *Choerodes transversa* of Walker, and *Halia wavaria*, a species introduced from Europe, where it has long been known to feed on the gooseberry.

The Raspberry is attacked by a beetle, (Fig. 9,) *Byturus unicolor*, say, which eats the fruit buds, and makes long slits in the leaves during June. And so on the list might be extended. Fig. 11, is a highly magnified view of a minute thrip, the *Heliothrips hatmorrhoidalis*, introduced from Europe, and infesting the hot-houses; these greatly injure the leaves of plants.

Respectfully submitted, per

J. STAUFFER.

Lancaster, Pa.

THE CODLING MOTH OR APPLE WORM.

This long and well known pest to the fruit grower, of which a good account and of its transformations was published in the fifth volume of "The

Massachusetts Agricultural Repository and Journal" as early as 1819, by Joseph Tufts, Esq., and by sundry persons since. And figured by Harris, C. V. Riley and others. It has been thought desirable to figure the various stages, as figured by Mr. Riley, for the benefit of those who have not the desired information.

During the latter part of June and the month of July, this fruit moth, (*Carpocapsa Tomenella,*) fly about apple trees every evening, and lay their eggs on the young fruit, which eggs they drop one by one, in the eye or hollow at the blossom end of the fruit, where the skin is most tender. They prefer the earlier kinds of apples. In a few days the eggs begin to hatch, when the little larvæ make their way from the eye to the core. One only is usually found.

The fruit seems to ripen earlier; to cause it to drop; the matured caterpillar leaves the fruit and seeks shelter under a chink in the bark of the tree, where they spin their cocoon, and change to a chrysalis. Some develop and produce a second crop of larvæ, others remain during the winter. Traps, to decoy the moth, is better than tarred ligatures around the tree, as some have recommended.

NO TO DONTA CONCINNA.

THE RED-HUMPED CATERPILLAR MOTH.

Different broods make their appearance at various times during August and September. The eggs are laid during the month of July, in clusters on the underside of a leaf, generally near the end of a branch. When first hatched they only eat away the underside of the leaf, but as they grow older, they devour whole leaves from the point to the stalk, leaving nothing of a leaf remaining. The young are lighter colored than the old ones, which are yellowish brown, paler on the sides, and longitudinally striped with slender black lines; the head is red; on the top of the fourth ring there is a hump, also of a red color; along the back are wart-like projections, the hinder joints of the body tapering somewhat, and always elevated at an angle with the rest of the body, when the insect is not crawling. The full grown caterpillars measure one inch and a quarter, or rather more in length. These may all disappear in a single night, by concealing themselves under leaves or just beneath the surface of the soil. The unicorn No to donta has similar habits to that of the one figured. The moth differs in coloring. They remain in their cocoons till the June following.

A minute moth is also described as ruining the leaves of the apple, a single leaf sometimes containing five or six larvæ. It is a new species of the *Micropteryx* (the M. pomivorella.) There is also found a new species

Main

Alipia
8 Maculata
from Europe

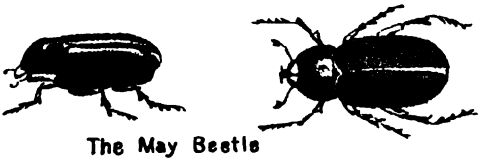
On our Grape Vines

Canker Worm & Moth

1 The cluster of Eggs
2 Eggs Magnified
3 The Worm
4 Chrysalis
5 Male insect on the wing
6 The wingless-female.

New York Weevil
on Apple Trees

Ithycerus Noveboracensis
so named by Foster one
hundred years ago.



The May Beetle
Lachnosterna Quercina

The fall Web-Worm
Hyphantria Textor, Harris,

1 The eggs partly seen through the nest
2 The Caterpillar
3 The Chrysalis
4 The perfect insect.

of Tortrix infesting the cherry—*Tortrix V-Signatana*, also a beautiful beetle called *coleophora cerasivorella*, and considered new.

ANESOPTERYX, VERNATA.

MOTH OF THE CANKER WORM.

About the middle of March, earlier or later according to the temperature, these insects come forth. The female is wingless and cannot fly, but has to crawl up the tree to lay her eggs, hence a tarred or sticky band around a tree is a protection against this species.

She deposits her eggs in clusters 60 to 100, closely glued together, and to the bark of the tree, usually in the forks of small branches, or close to the young twigs. The eggs hatch about the middle of May. The larvae are a span-worm or measurer, they become full grown in about four weeks, they then drop by a web or thread and swing, as often seen dangling from the end of the branches of apple trees, of which they are very fond, but the elm, plum, cherry and basswood are not exempted.

THE FALL WORM.

Hyphantria Textor, differs from the tent caterpillar of the orchard, the *Clisiocampa Americana*, and those of the forest are the *Clisiocampa Sylvatica*. This spins its tent around the leaves upon which it feeds, in the forks of terminal limbs of trees and shrubs, and never gets outside of its nest until it is full grown and travels to find a favorable place to pass through the pupa state. These do not deposit their eggs in bands, but in nests partially webbed in, deposited during the latter part of June and first of July, on the leaves. At first the web only covers one leaf by the young larvæ, but as they grow they spin from leaf to leaf. These caterpillars are first pale yellow, not so hairy as when full grown; the whiteish hairs spring from black and orange-colored warts, and about one and a quarter inch long. These form their cocoon and undergo their change to the moth, which is white, slightly tinged with a dull yellow color.

The so-called new pest of the orchard, a large snout beetle, of an ash gray color, marked with black. The figures give a dorsal and side view of the female (a) and (b) the male. This new pest in some sections was named by Foster, *Ithycerus noveboracensis*, one hundred years ago. Apple appears to be its preferable food, although it attacks the pear, plum, peach and cherry. It feeds actively at night and appears sluggish during the day. Before the buds put forth it destroys them; later in the season it forages on the tender shoots from the old wood and the soft bark at the base of the buds, thus playing sad havoc in orchards.

Mr. T. C. Finlayson sent specimens, a few years ago, of this "New York Weevil," as it was called, which had done him great damages, and is as notorious for mischief as the so called "Little Turk," on the plum, &c.

The May beetle belongs to the "Rouges' Gallery," they often do much mischief in the nursery. The white grub, as it is called, is the larvæ of this species of bronze colored bugs, called Lachnosterma quercina. One writer says, "they are skinning the leaves of my rose bushes, mountain ash, plums, &c., but don't touch apples or cherries. The grubs attack strawberry beds, &c., in loose soil where they undergo their change.

PENNSYLVANIA STATE COLLEGE—1875.

We respectfully submit the following report of the Pennsylvania State College, for the year ending December 31, 1875.

JAMES A. BEAVER, *President.*
JAMES CALDER, *Secretary.*

STATE COLLEGE, *February* 15, 1876.

REPORT OF THE PRESIDENT OF THE COLLEGE.

The year now closing has been one of more than average prosperity to the College. Although financial embarrassment has been widely felt, and, consequently some of our students have been unable to continue their studies, an unusual number of candidates have applied for admission, and thus our whole number has been greater than that of last year

DISCIPLINE.

In application to study, observance of college regulations, freedom from evil habits and cheerful yielding to the claims of morality and religion the great majority of our students may be spoken of in terms of high commendation. In the few instances in which severe discipline has been needful its administration has been supported by the students as a body, and the results have been salutary.

CLAIMS OF RELIGION.

In the beginning of the year the claims of religion as a personal experience were voluntarily considered by a large number; and the examination of the subject led many to profess their faith in Christ as their Savior. Beside the usual chapel exercises, special religious services have been maintained by the students throughout the year; and a Young Men's Christian Association has been organized.

COMMENCEMENT WEEK.

The exercises of commencement week were of a very satisfactory character, and were participated in by a large number of visitors. Many persons visited the institution for the first time; and the statement of their impression, through the press and otherwise, has been very gratifying and encouraging to those who have the management of its affairs. In every instance in which a visitor has come with a feeling of hostility to the College, or a prejudice against its distinctive features, he has lost it while here; and in some cases such persons have become the earnest friends and helpers of the institution in the performance of its peculiar work. We be-

lieve that to be more fully appreciated and patronized the College needs only to be more fully known.

COURSES OF STUDY.

Several changes in the courses of study being deemed desirable such endargement and modifications as were practicable have been made. The chair of Ancient Languages has been divided, and the facilities for the study of Latin and Greek have been increased. A chair of Modern Languages has been established, whereby an opportunity to secure a good practical knowledge of French and German is offered to all who may desire it. A course of lectures on Social Economy and another on Commercial Law have been introduced; and enlarged facilities for the study of history have been provided. Instruction in phonography by an experienced reporter has been secured; and increased time has been given for practical instruction in book-keeping. In several instances studies have been made elective in order to meet peculiar desires and preferences; and thus the breadth and usefulness of the College have been enlarged.

IMPROVEMENT OF BUILDINGS.

The increase of the Faculty and the enlargement of the courses of study called for enlarged facilities for the hearing of recitations and lectures. Therefore three recitation rooms have been added to our former number; and, with the exception of the Professor of Mathematics, each instructor has a room in which he can perform the work of his department. The present mathematical room is too small, and is otherwise unfitted for the purposes to which it is devoted, and should be exchanged for a better one as soon as possible. Apartments for another family have been prepared in the main building, and are occupied by the Professor of Chemistry and Physics. The several buildings of the College, except those pertaining to the farm, have been painted; and thus have been greatly benefited by a work which was deferred too long.

The Washington Literary Society, occupying rooms on the fifth floor of the main building, have greatly improved and beautified their hall, without expense to the College treasury.

MILITARY DEPARTMENT.

The election to the chair of modern languages of a gentleman who is also well versed in military science has enabled us to pay more attention to tactics, a branch which we are expressly required, by the law of Congress, to include in our courses of study. Under his supervision the cadet corps has steadily improved, and some modifications in the administration of discipline have been introduced with advantageous results.

By invitation, the cadets attended the re-union of the Pennsylvania Reserves, at Williamsport, in June, and the annual agricultural exhibition, at Bellefonte, in October. On both occasions their deportment and efficiency were highly spoken of, and were creditable to the institution. On the occasion of a visit to the College, made in December, by the Governor and other State officials, the cadets received our guests with the appropriate artillery salute, and were carefully reviewed by the Adjuant General, who speaks favorably of their soldierly qualities.

This department greatly needs a larger armory, and should have a drill hall in which instruction could be given and exercise be taken on occasions in which the weather forbids the use of the parade ground.

COLLEGE DEBT.

The floating debt of the College has been reduced by the payment of $6,600, an achievement which has been accomplished only by the most rigid economy, and by leaving undone many things which should have been done. By the continuance of our present policy the floating debt, which has long been a serious embarrassment, will be entirely liquidated in three or four years.

The funded debt, amounting to $80,000, which was contracted in order to finish the main building, will be due on the 1st of April, 1876. The annual interest on this large sum, amounting to $5,600, has been a great drain upon the resources of the College. As the Legislature, in accepting the proceeds of the Congressional Land Grant, pledged the State to meet the conditions on which the grant was made, we feel that the same body should long ago have given the College a home free from all incumbrance, and not have crippled it with the heavy debt which it has been carrying through many years. Confident that the present emergency will secure the needful attention, we now appeal to the State to provide for the payment of the bonds at their maturity; and pledge ourselves to the judicious use of the funds which will thus be released, for whose wise employment we have had ample time to prepare through the years in which they have been turned aside from their legitimate use.

DONATIONS.

P. Gray Meek, Esq., of Bellefonte, has made a donation of several valuable volumes for the library. The stock on the Central Experimental Farm has been materially improved by the addition of an Alderney cow and calf, the gift of Wm. T. Hildrup, Esq., of Harrisburg, and the gift of an imported Alderney bull and cow from Wm. Calder, Esq., of the same city. A fine portrait of Hon. H. N. M'Allister, deceased, has been presented by his relatives.

AMENDMENTS TO THE CHARTER.

On petition of the Board of Trustees the court of Centre county has approved several amendments to the College charter, which it is believed will enable the institution to more fully meet the expectations of its patrons, and prepare it for greater usefulness in the future.

Respectfully submitted,

JAMES CALDER,
President.

To JOHN HAMILTON, ESQ., *Professor of Agricultural State College of Pa.:*

The superintendent of the Eastern Experimental Farm, herewith respectfully tenders his report of the experiments conducted on this farm, and of its condition and general management:

The general results of these experiments do not differ materially from those of previous years. We find, as heretofore, that sub-soiling, on our farm land, does not pay. Occasionally a benefit may be noticed, but only such as might result from the more thorough pulverization attending the stirring of the soil 16 or 18 inches deep. The increased labor is almost an entire loss. Our subsoil is porous and affords natural drainage.

The most of our land had been heavily limed a few years previous to its occupation as an Experimental Farm, which probably accounts for the limited action of lime, in the experiment, with that fertilizer. No doubt a sufficiency for the growing crops is still latent in the soil.

Experiments with other commercial fertilizers, indicate that those containing largely of the mineral elements are more desirable, particularly those containing soluble phosphate of lime, arising no doubt from the fact that this section has long been a grazing country, thus making a heavy drain upon this element of fertility. The disintegrating feldspar rock of this section keeps up the supply of potash, hence our experiments do not show good results from the use of commercial potash, except for fruit trees, which I will refer to again. The purchase of commercial ammonia has not been remunerative with us, and we conclude, that as a rule, farmers should look for a supply of this element to be furnished by their yard manure, soiling crops, &c, Permit me to say that from our experience, farmers might be safely commended to a generous trial of a well acidulated South Carolina phosphoric rock, any showing a high grade of solubility. There is perhaps less fraud in this class of goods than in almost any other commercial fertilizing compound, and as a general thing affords soluble phosphoric acid, at a cheaper rate per pound than from most other sources. Latterly this has been our main dependence as a foreign supply for the general improvement of our farm; and the appearance of our crops show

its application to be judicious. I have no doubt that any naturally good corn land in our section can be made to produce 60 to 100 bushels of corn per acre, by a judicious use of this fertilizer; our main crops so treated, made this season at least 100 bushels per acre.

Our experiments, comparing different manners of seeding wheat, still continues to show in favor of broadcasting. There seems to be no way to account for this result except that the drill, as usually run, puts the seed in such narrow grooves that the roots are necessarily cramped and stunted. In corn, however, we continue to give the preference to the drill on account of its expedition, and because it puts the seed in the moist earth and at any depth we wish.

Among the new varieties of wheat, we deem the Fultz a very valuable acquisition, in this section, on account of its hardiness, productiveness and good milling quality. It stands up well, ripens early, and adapts itself well to thin or strong land. Last year's experience with Clawson or Seneca wheat was also favorable; the yield and quality both good. Among the new varieties of oats tested there seems to be nothing worthy of special commendation. The Hulless oats was given a pretty thorough trial, but proved worthless with us. It is fair to say, however, that our section of latter years has become unsuited to the production of oats. We continue to make many experiments with potatoes, testing manners of planting, varieties, &c. Notwithstanding numerous theories and assertions, our experience shows that the old method of planting, usually adopted by farmers, of cutting indiscriminately the large and small potatoes, (not going to extremes, of course,) and using both root and blossom end, was practically as good as any. We have never succeeded in showing any of the newly introduced varieties as greatly preferable, and a seedling of our own, (No. 27,) a cross between Early Rose and Goodrich, for productiveness and quality has been unsurpassed by any of them.

We still continue to practice stock soiling to a considerable extent, confining our cattle until the second crop grows on our mow and stubble fields, which we pasture to some extent.

We find our stock do equally well confined to small lots or yards, if carefully attended, as when allowed the liberty of the fields, and can be fed on one-third less land.

We have found purple Lucern (*Medicago sativa*) to be a good soiling plant on strong land, yields heavily, grows rapidly, bears cutting, and is perennial

Permit me to call your attention to the product of our orchard. We are giving this department more attention, and are amply repaid. It is, as you know, only a small orchard, selected and planted more for testing varieties than for profit, yet its gross returns are nearly $900, besides fruit

consumed and the various root and truck crops raised among the trees. Our treatment of this orchard, which seems to be successful, is surface cultivation, good manuring, as far as our means will permit, scraping and washing the trees with an alkaline mixture and a dressing of five or six pounds of muriate of potash per tree. The trees were remarked as retaining their foliage and perfecting their fruit to an unusual degree. Some of our Bartlett pears weighed over one pound each, and were the finest of any others exhibited at the fairs where they were shown. Our selected Bartlett and Sickles, also very fine, sold at four to six dollars per bushel.

From our experience we could safely urge the farmers of Eastern Pennsylvania, or indeed any suitable locality, to pay more attention to fruit growing, and can assure them that better treatment and more intelligent labor expended upon their orchards will repay them as well as any other branch of agriculture.

In summing up, I am sorry to report that our very limited means have constrained us to do so little, when from the exigencies of the times agriculturists need encouragement and need light thrown upon every item of their business. Farmers cannot afford to grope in the dark, neither have they time, means or opportunities to give questions of doubt in agricultural matters that thorough investigation their importance demands. Their systematic solution by such institutions as those under your charge is not only a subject of deep interest to farmers, but a matter also of national importance.

I am happy to report that the intelligent farmers of our vicinity appreciate the necessity of the aid of such institutions, and the great need of State aid and protection to them, such as will enable them to be of greater value to the farmer and a credit to the Commonwealth.

Very respectfully submitted,

JOHN I. CARTER,

Supt. Eastern Experimental Farm

COMPARING VARIETIES OF WHEAT.

The field used in these experiments was an oats stubble, fertilized with acidulated South Carolina rock; plowed September 1, and seed sown broadcast September 28, at the rate of two bushels per acre. Plots contained one-eighth acre.

	VARIETY.	Smooth, &c.	Color.	Time Ripe.	Lbs. straw.	Lbs. of grain.
1	Herne, from Ky	Smooth	White	July 7	140	64½
2	Red Chaff Medit'n	Bearded	Red	do 9	215	90
3	Brittany	do	do	do 9	275	110½
4	Old White Chaff Med	do	Amber	do 9	230	83½
5	Week's White	do	White	do 9	230	93
6	Jenning's White	do	do	do 8	290	109½
7	Clawson or Seneca	Smooth	do	do 8	435	170½
8	Rodger's	do	do	do 9	361	135
9	Fultz	do	do	do 7	400	170¾
10	Winter oats from Va	Winter killed.				
...	Fultz, drilled in	1½ bushels seed.			320	108½
...	Fultz, drilled in	2 do do			420	125
...	Fultz, plowed in	2 do do			420	157½
...	Fultz, broadcast	2 do do			400	160¾

AN EXPERIMENT TESTING DIFFERENT VARIETIES OF OATS.

The field used for this purpose was in corn last season; land in fair condition; was plowed for oats April 14 and 15; seed sown April 24, at the rate of two and a half bushels per acre, and harrowed in with spike harrow. Plots contained one-sixteenth of an acre.

No. plot.	VARIETY OF OATS.	Color of grain.	Time ripe.	Bushels per acre.
1	Surprise	White	July 22	34.8-32
2	White Schoenen	do	do 25	44.12
3	Houghton	do	do 22	34.24
4	Fellow	do	do 22	40.16
5	Early Yellow	do	do 25	44
6	Hull-less	do	do 28	15
7	Black Norway	Black	do 28	35
8	Canadian	White	do 22	30
9	Somerset	do	do 24	32

DRILLING VERSUS BROADCAST, &c.

The following plots were planted under similar circumstances with those above, except as mentioned:

	Pounds per one-eighth acre.
1. Seed drilled in, 2½ bushels per acre	127
Seed broadcast and harrowed in, 2½ bushels per acre	116½
Fertilizer drilled in with seed	140
Fertilizer sown broadcast with seed	120

COMPARING VARIETIES OF POTATOES.

The land used in this experiment was in potatoes last year. Was well manured this spring with yard manure plowed down. The potato rows were struck out three feet apart, and acidulated South Carolina rock applied in the row, at the rate of 600 pounds per acre. Potatoes cut and planted May 5, sets being eighteen inches apart in the row.

	VARIETY.	Quality.	Time ripe.	Yield per acre.
1	Blush, N. J., Sharpless	Good	Early	111.20-60
2	Compton's Surprise	Medium	Medium	93.14
3	Climax	do	do	134.17
4	Seedling, No. 27, (Experimental farm,)	Good	Late	212.13
5	Seedling, No. 38	Medium	do	205.16
6	Seedling, No. 21, (G. C. Brown)	do	do	125.15
7	Western Reserve	do	do	118.59
8	Extra Early Vermont	Good	Early	52.11
9	Keystone, (from Mr. Lott)	Fair	Late	133
10	White Granger.....do	do	do	178.19
11	Brownell's Beauty	do	Medium	61.32
12	Snowflake	Good	do	75.38
13	Brownell's Eureka	do	do	77.51
14	King of the Earlies	do	Very early	50.48
15	Excelsior	do	Late	90.27
16	Peerless	Poor	do	135.41
17	White Peach Blow	Good	Very late,	51.31
18	Early Rose	do	Early	96.29
19	Late Rose	Fair	Late	82.53

FERTILIZERS ON WHEAT.

This field was an oats stubble, plowed September 4th. Seed wheat drilled in September 28th. Fertilizers sown broadcast and harrowed in at the rate of $9 00 worth per acre. Plots contained an $\frac{1}{8}$th of acre. Fultz wheat sown, ripe July 8th, threshed July 15th, and weighed :—

	KIND OF FERTILIZER.	lbs. of fertilizer.	lbs. of straw.	lbs. of grain.
1	Barn yard manure	.....	400	170
2	No fertilizers	.....	350	148
3	Salt	1 bushel.	366	169
4	Acid'ed S. Carolina Rock, drilled in with the seed	75 lbs.	440	190
5	Boston animal fertilizer	45 "	295	152½
6	Nitrate of soda	20½ "	300	153
7	Muriate of potash	37½ "	305	154
8	Sulphate of ammonia	17 "	340	160½
9	Acid'ed S. Carolina Rock, double quantity	150 "	390	180½
10	Ground bone, double quantity, (Thomas,)	90 "	350	175
11	Acid'ed S. Carolina Rock, (Lennig,)	75 "	315	157
12	Pure bone, super phos	40 "	355	185¼
13	Ground bone	45 "	285	159

TESTING THE CONTINUED ACTION OF FERTILIZERS ON VARIOUS CROPS.

In 1872, plots containing one-eighth of an acre were laid out, and the following fertilizers applied, at the rate of ten dollars worth per acre, for the wheat crop. The fertilizers were sown broadcast and harrowed in, except where otherwise stated.

Wheat sown September 17, 1872. The results on the succeeding crops are noted:

	Bushels of wheat per acre in 1873.	Pounds of hay per acre in 1874.....	Bushels of corn in 1875 per acre, 72 lbs. to a bushel..
1. Bone and ashes, (compost,).....	30.28-60	5,552	93.44-72
2. Acidulated South Carolina rock.....	34.22-60	5,600	93. 4-72
3. Kainite.....	29.54-60	4,000	87.10-72
4. Prof. Ville's wheat food.....	33.28-60	4,960	91. 8-72
5. No fertilizer.....	25.20-60	3,920	81.64-72
6. Ground bone, sown broadcast.....	29.38-60	5,648	98.24-72
7. Ground bone, one-half sown broadcast, and one-half drilled in.....	31.44-60	5,728	97.50-72
8. Ground bone, drilled in with the wheat.....	33.36-60	5,680	98.64-72

In the above experiment it will be noticed that the acidulated rock made a gain of $9\frac{2}{60}$ bushels per acre of wheat over the plot with no fertilizer the first year, and a gain of 1,680 pounds of hay in the second, and a gain of $11\frac{12}{72}$ bushels of corn in the third. Valuing the wheat at $1 30 per bushel, and the hay at $15 00 per ton, and the corn at 50 cents per bushel, and we have an aggregate gain from the application of $29 94, or $19 94 above cost. Applying the same calculation to the plot upon which bone was applied, and we have an aggregate gain of $26 83.

On April 10, 1874, we applied fertilizers on contiguous plots to the above for grass, resulting as follows:

	Pounds of fertilizer per ⅛ acre,	Pounds of hay per acre in 1874,	Bushels of corn per acre in 1875,
1. No Fertilizer		4,880	90
2. Plaster, (sulphate of lime,)	1 peck.	5,200	86.48-72
3. J. P. Thomas' ground bone	50 lbs.	5,280	96. 8-72
4. Pure bone phos	45 "	5,880	97.16-72
5. Acidulated South Carolina rock	75 "	5,600	98.40-72
6. Sulphate of ammonia	17⅓ "	5,440	81.48-72
7. Nitrate of soda	20½ "	5,400	80
8. Muriate of potash	41 "	5,312	83.64-72
9. Boston animal fertilizer	45 "	4,992	82.56-72
10. Salt, (chloride of sodium,)	1 peck.	4,968	76.48-72
11. Six lbs. of ammonia, 7 lbs. nitrate of soda, 25 lbs. acidulated South Carolina rock	38 lbs.	4,728	86.48-72
12. Acidulated South Carolina rock, double quantity	150 "	6,040	95
13. No fertilizers		4,440	78.64-72
14. Equal parts potash and soda		4,800	75

To test different modes of applying fertilizers for corn, we took one-eighth acre plots contiguous to the above, and applied acidulated South Carolina rock, as follows:

	Bushels of corn per acre in 1875.
Acidulated South Carolina rock, plowed down	$97\frac{36}{72}$
Acidulated South Carolina rock, sown on surface and harrowed in	$88\frac{64}{72}$
Acidulated South Carolina rock, drilled in with corn	$80\frac{40}{72}$

EXPERIMENTS WITH FERTILIZERS ON WHEAT.

In the same field we made some experiments with fertilizers, using at the rate of $9 worth per acre; plots containing one-eighth acre. Fultz wheat, drilled in, September 23; fertilizers sown broadcast, and harrowed in, the ground had a light coat of yard manure plowed down.

FERTILIZERS	lbs. of fertilizer	lbs. of straw per ⅛ acre	lbs. of grain per ⅛ acre
Mixture*	45	485½	270½
Sulphate of ammonia	17	459	235
Muriate of potash	37½	492½	259½
Dissolved South Carolina Rock, (bought,)	75	497	256½
Dissolved South Carolina Rock, (home-made,)	68	446¾	269¼
Bone super phosphate	50	519	269
Fine ground bone, (Warings,)	47½	561	290
Coarse ground bone....do	45	453½	242½
Kainite	83	540½	282½
Mixture drilled in with the wheat	45	484½	255½
Mixture, double quantity	90	586½	293½
Cook's super phosphate	45	500	290
Sulp. ammonia, 8½ lbs.; dissolved S. C. rock 34 lbs.	42½	471½	264½
Muriate potash, 19 lbs.; dissolved S. C. rock, 34 lbs.	53	.....	.....
No fertilizers	.....	430	230

*Mixture used on wheat, compounded as follows:
225 lbs. dissolved South Carolina rock.
44 lbs. sulphate ammonia.
88 lbs. muriate of potash.
Quantity for one acre.

EXPERIMENTS WITH VARIETIES OF WHEAT.

The ground used in these experiments was an oats stubble, to which had been applied a light coat of barn-yard manure and $9 worth of fertilizer, all plowed down August 21. The ground was then thoroughly prepared, and laid out in one-eighth acre plots, and the wheat sown broadcast, at the rate of two bushels per acre, on September 22, 1873.

No. of plot.	VARIETY.	Ripe.	Color.	Bearded or smooth.	lbs. straw per ⅛ acre.	lbs. grain per ⅛ acre.	Bush. per acre.
1..	Jennings	July 4,	White..	Bearded..	574	251	33.28-60
2..	Shoemaker	July 8,	Red.....	Smooth...	438½	206½	27.32
3..	Fultz	July 2,	Amber..	Smooth...	685	315	42
4..	Rogers	July 8,	White..	Smooth...	563½	261½	34.52
5..	Rough and Ready	July 4,	Amber..	Sm'h & bd	523	267	35.36
6..	Week's White	July 4,	White..	Bearded..	436½	233½	31.8
7..	Way Wheat	July 4,	Red.....	Bearded..	514	256	34.8
8..	Lancaster	July 6,	Red.....	Bearded..	538½	196½	26.12
9..	Brittany	July 4,	Red.....	Bearded..	494	283	37.44
10..	Winter Barley	June30,	.....	.....	337½	262½	43.36
11..	Dot Wheat	July 4,	Red.....	Bearded..	590	262	34.56
12..	Arnold, No. 9	July 8,	White..	Smooth...	394½	215½	28.46
13..	Old White Chaff, Med	July 6,	Red.....	Bearded..	474½	255½	34.4

At the same time and with similar circumstances, we compared manners of planting.

		lbs. grain.	lbs. straw.	Bushels per acre.
1. 2	bushels Fultz, seed plowed in three inches deep....	611	264	35.12
2. 2	....do.....do.....drilled in.....	560½	309½	41.16
3. 1½	....do.....do.....do.....	467½	280½	37.24
4. 2	....do.....do.....broadcast, harrowed in.....	685	315	42

FERTILIZERS ON CORN.

The plots used in these experiments had been mowed in 1872 and 1873. The fertilizers applied in the spring of 1873, at the rate of $9 00 per acre, and were continued for corn to test the durability of the fertilizers—the corn was drilled in May 12, in rows three feet nine inches apart—hills two feet six inches, two stalks to a hill, corn cut October 1st, and husked October 25th.

No. of plot.....	KIND OF FERTILIZERS.	lbs. of fertilizer used —sowed 1873.....	lbs. of corn, ears, in 1874, 1-16 of acre..	lbs. of hay from 1-16 acre in 1873.....	Gain in hay in 1873, over 1872, from use of fertilizers.....	Bushels of corn per acre, 72 lb. per bus.
1	No fertilizer	.....	294	234	.....	65.24
2	Muriate of potash and nitrate of soda, (equal parts,)	.....	387	310	122	86
3	Sulphate of ammonia	.....	363	290	116	80.48
4	Plaster	1 peck.	364	252	91	80.64
5	Bone super phospate	.....	366	312	145	81.24
6	Dissolved S. C. Rock	.....	424	366	194	94.16
7	Kainite	.....	415	256	62	92.16
8	Sharpless' mixture	.....	349	267	67	77.40
9	Ground bone	.....	396	273	14	88
10	Bone and ashes, (compost,)	.....	435	256	3	96.48
11	Lime and salt	.....	384	269	5	85.24
12	Cope's ammonatu	.....	380	314	53	84.32
13	Coe's super phosphate	.....	455	372	138	101.8
14	Baugh's super phosphate	.....	449	349	49	99.56
15	Berger & Butt's super phosphate	.....	379	361	116	84.16

VARIETIES OF OATS, &c.

Plots containing one-fourth acre were laid out on cornstalk ground, land plowed and oats harrowed in April 4, 1874, resulting as follows:

No. of plot.....	VARIETY OF OATS.	Pounds of straw per ¼ acre.....	Time of ripening.....	Weight of grain per bushel, lbs.,	Bushels per acre.
1	Houghton, from Agricultural Department	321	July 27,	29	23.20
2	Fellow oats, from Agricultural Department	206	" 20,	32	24
3	Early Yellow	236	" 20,	33	23
4	Somerset	241	" 20,	33	24.10
5	White Schoenen	225	" 27,	25½	26.4
6	White Poland	263	" 20,	32	25.12
7	Black Norway	309	" 27,	25	24.20
8	Surprise	239	" 20,	31	24.4

In the same field were one-fourth acre plots, testing quantity of seed, drilling, broad casting, &c. Variety of seed used, the Surprise, sowed April 4.

	Pounds of straw per ¼ acre.....	Weight of grain per bushel.....	Bushels per acre.
Two bushels broadcast	239	31	24.4
Three bushels drilled in	269½	31	26.10
Two bushels drilled in	294½	31	27.18

In the same field were one-eighth acre plots upon which the fertilizers had been sown when put down to wheat in September, 1872. Retained to test the continued action of the fertilizer upon the succeeding grass crop. Value of bone and ash compost per acre, $9.

No. of plot.....	KIND OF FERTILIZER.	Pounds of wheat per one-eighth acre in 1873.....	Pounds of hay per one-eighth acre in 1874.....
1	Bone and ash compost	228½	634
2	Dissolved South Carolina rock	257½	700
3	Kainite	223	500
4	Prof. Ville's Wheat Food	251	620
5	No fertilizer	190	490
6	Ground bone on surface	222½	706
7	Ground bone, one-half the bone sown broadcast, one-half drilled in with the wheat	238	716
8	All the bone drilled in with the wheat	252	710

FERTILIZERS ON GRASS, 1874.

Plots containing one-eighth acre were laid out on wheat stubble sod; first year of mowing and the fertilizers applied at the rate of $9 per acre, and sown April 10, 1874. The plots were mowed June 26 and housed dry June 27

No. of plot.....	KIND OF FERTILIZER.	Pounds of fertilizer per one-eighth acre...	Pounds of hay per one-eighth acre.....
1	No fertilizer	.....	610
2	Plaster	1 peck	650
3	J. P. Thomas' ground bone	50	660
4	Bone super phosphate	45	735
5	Dissolved South Carolina rock	75	700
6	Sulphate of ammonia	17½	680
7	Nitrate of soda	20½	675
8	Muriate of potash	41	664
9	Boston animal fertilizer	45	624
10	Common salt	1 peck	621
11	Mixed, 6 lbs. sulp. ammonia, 7 lbs. nitrate of soda, 25 lbs. dissolved South Carolina rock	38	591
12	Dissolved South Carolina rock, double quantity	150	755
13	No fertilizer	.....	550
14	Potash and soda, equal parts	.....	600

POTATOES

To test fertilizers, we applied the following in the row, at the rate of $16 50 per acre, with a light coat of manure plowed under as above. The variety of potato used was the seedling, No. 27; sets, 18 inches in the row; rows, 3 feet apart, and 220 feet long:

No.....	KIND OF FERTILIZER.	Potatoes, lbs per row.....	lbs. of fertilizer.....
1	Bone Super Phosphate	212	10
2	Dissolved S. C. Rock	179	16¾
3	J. P. Thomas' Fine Ground Bone	195	11¾
4	Muriate of Potash	137	9¼
5	Nitrate of Soda	148	4¼
6	Sulphate of Ammonia	131	4
7	Boston Animal Fertilizer	191	10
8	Mixed, ⅓ Potash, ⅓ dissolved S. C. Rock, and ⅓ Sulp. Ammonia,	208½	.....
9	Plaster	197½	1 pk.
10	Yard Manure	189	.....
11	No fertilizer	164	.....

To test the size of tubers planted, we made the following experiment. Potatoes planted May 7—variety, Excelsior.

No.	ROWS MARKED OUT WITH PLOW, AND THREE FEET APART.	Sets Apart.	lbs. per row.
1	Large and whole	18 inches.	144
2	Medium and whole	18 "	117
3	Small and whole	18 "	115
4	Medium and cut	18 "	110
5	Medium and cut	9 "	150

EXPERIMENTS WITH POTATOES, 1874.

Upon corn-stalk ground a light coat of barn-yard manure in early March and plowed under on the 15th of same month. We also plowed under at the same time 800 pounds of dissolved South Carolina rock per acre. Rows were then marked out 3 feet apart, sets planted 18 inches, and covered with a plow, on the 28th of April. Potatoes dug September 5.

No. of row.	KIND OF POTATO.		Bushels.
1	Peerless	Medium.	116
2	Excelsior	Good	112
3	Climax	do	145
4	Peach Blow	do	45
5	Late Rose	Medium.	71
6	Early Rose	Good	123
7	King of the Earlies	do	68
8	Blush (of N. J. Sharpless)	do	137
9	Seedling, No. 27	Medium.	180
10	Seedling, No. 38	do	157
11	Extra Early Vermont	Good	91
12	Compton's Surprise	do	110
*13	Western Reserve	do	144
*14	Seedling, No. 21	do	103
15	Brownell's Beauty	do	135

The drouth injured the early potatoes, and the Colorado beetle the late ones.

* These two varieties came from Gerald C. Brown, Croton Falls, N. Y.

REPORT OF COMMITTEE APPOINTED TO CONDUCT THE TRIAL OF MOWERS AND REAPERS AT THE PENNSYLVANIA STATE COLLEGE, 1875.

CENTRE COUNTY, PENN'A, *July* 28, 1875.

To the President of the Pennsylvania State College:

The undersigned, appointed a Committee to conduct the trial of mowers and reapers at the farm of the Pennsylvania State College during the Commencement exercises of sessions 1874–75 of that Institution, have the honor to submit the following report, viz:

That the trial of mowers was made on the afternoon of July 27, that of reapers on the afternoon of July 28. For the former, seven (7) entries presented themselves, for the latter, six (6). (See annexed tables).

A field of timothy and clover was, by the Professor of Agriculture, placed at the disposition of the Committee for the trial of the first class of machines, a field of Excelsior oats for the trial of the second class of machines.

The perfection to which the cutting apparatus of mowers has been brought, rendered it very difficult for the Committee to decide as to the superiority of the work done, they examined, therefore, in reference to draft, simplicity of construction, noise, &c., and report as per adjoined table:

NAME OF MOWERS.	Rank.....	Draft.....	Length of cutting bar.....		Simplicity of construction.....	Noise.....	Quality of work..
			ft.	in.			
Single machines:							Work done well by all—the timothy and clover used in the experiment being too light fully to test capacities.
Wm. Aus. Wood, "Eagle,".....	1	170	4	3	100	90	
Champion.....	2	180	.....		95	80	
Wal. A. Wood.....	3	190	4		95	80	
Kirby Mower.....	4	200	4	3	90	80	
Combined machines:							
Russell.....	5	210	4	3	95	70	
Hubbard "Meadow Lark,".....	6	210	4	6	85	80	
World.....	7	300	4	3	75	60	

In the trial of the reapers the committee's action was, in the main, based upon the same reasons as during the trial of mowers. They were however able to decide more definitely as to the neatness and effectiveness of the work done. To test this fully during the latter part of the contest, the spectators were requested to walk repeatedly through the oats, so as to beat

down and tangle them; and the machines were tried also under these less favorable circumstances. The committee report, as per adjoined table:

NAME OF REAPERS.	Rank.....	Length of cutting-bar.....	Simplicity of construction...	Noise.....	Quality of work.
		ft. in.			
Russell	1	5	90	95	100
Burdick	2	5 6	100	95	95
Wm. Aus. Wood	3	5	85	90	90
Champion	4	5	85	100	85
Wal. A. Wood	5	5 6	80	85	75
Hubbard	6	5 3	60	75	50

In the decisions upon simplicity of construction, noise and quality of work, 100 was taken as the maximum standard; 50 was taken as the minimum standard.

Very respectfully,
Your obedient servants,
SAM'L GILLILAND,
A. GRABOWSKII,
J. H. ORVIS,
J. A. WOODWARD,
Committee.

REPORT OF THE CENTRAL EXPERIMENTAL FARM FOR 1875.

CENTRAL EXPERIMENTAL FARM,
PENNSYLVANIA STATE COLLEGE, *December* 1, 1875.

To JOHN HAMILTON, *Prof. of Agriculture, &c.:*

SIR:—I have the honor to transmit herewith, the accounts of the Central Experimental Farm, for the year just closed. The crops have yielded a good average, although the corn has suffered slightly from the grub-worm. Besides the ordinary farm work, the old road on the eastern side of the farm has been filled and leveled, and is now in grain. Also a new fence has been erected along the whole front of the farm, which was nicely whitewashed, and which adds greatly to the appearance of the farm from the road The fence which was to have been erected on the eastern side by Mr. Musser, has been finished. The farm now has good fences on three sides, all within two years old, and we intend putting one on the fourth side the coming year, the posts for which have been purchased. Other buildings contemplated which were needed, have not been erected, on account of the small amount of appropriation. The stock of cattle has been changed, and we now have a herd of full and half blood Alderney cattle which have been

kindly donated by Messrs. W. C. Calder and W. T. Hildrup, of Harrisburg, and hope to be able to report a greatly increased amount of butter and milk next year, over all previous reports.

Our poultry has been visited by the cholera, and so greatly reduced that all the increase will not make the complement reported last year.

In view of the buildings absolutely needed, and repairs to the house to make it comfortable, I would respectfully request that the appropriation for the coming year be increased to $1,000 instead of $600, the appropriation for the past year.

All of which is respectfully submitted.

WILLIAM C. HUEY,
Superintendent.

FIRST TIER OF PLOTS.

Rotation of crops.							
	Number of plot	1.			2.		
	Treatment	Common plow.			Sub-soil plow for corn, Michigan for wheat.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Barley	Common		Barley	Common	
	When planted	April 21	April 23		April 21	April 23	
	How planted	Broadcast	Broadcast		Broadcast	Broadcast	
	When matured	July 23	July 17		July 23	July 17	
	When cut	July 23	July 17		July 23	July 17	
	When housed	July 25	July 21		July 25	July 21	
	Product, straw	177	170		172½	150	
	Product, grain	65	83		62½	77	
	Page of report						

Rotation of crops.							
	Number of plot	6.			7.		
	Treatment	Sub-soil plow for corn, Michigan for wheat.			Common plow.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Oats	Oats		Fallow.	Fallow.	
	When planted	April 21	April 23				
	How planted	Broadcast	Broadcast				
	When matured	July 22	July 30				
	When cut	July 22	July 30				
	When housed	July 25	Aug. 9				
	Product, straw	192½	200				
	Product, grain	82½	79				
	Page of report						

Rotation of crops.							
	Number of plot	11.			12.		
	Treatment	Sub-soil plow for potatoes, Michigan for wheat.			Common plow; butt grain.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Oats	Oats		Oats	Oats	
	When planted	April 23	April 26		April 23	April 26	
	How planted	Broadcast	Broadcast		Broadcast	Broadcast	
	When matured	July 23	July 30		July 23	July 30	
	When cut	July 23	July 30		July 23	July 30	
	When housed	July 23	Aug. 9		July 23	Aug. 9	
	Product, straw	205	250		210	200	
	Product, grain	82	89		84	88	
	Page of report						

Rotation of crops.							
	Number of plot	16.			17.		
	Treatment	Sub-soil and Michigan plows, alternate years.			Common plow; lime, 50 bushels per acre.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Potatoes		Oats	Oats	
	When planted		May 15		April 23	April 26	
	How planted		Drills		Broadcast	Broadcast	
	When matured		Oct. 11		July 23	July 30	
	When cut				July 23	July 30	
	When housed		½L. & W		July 23	Aug. 9	
	Product, straw		400		235	210	
	Product, grain		½ ct., 380		95	80	
	Page of report						

EXPERIMENTAL FARMS.

FIRST TIER OF PLOTS.

3.			4.			5.		
Common plow.			Sub-soil plow for corn, Michigan for wheat.			Common plow.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Barley	Common		Barley	Common		Oats	Oats	
April 21	April 28		April 21	April 23		April 21	April 26	
Broadcast	Broadcast		Broadcast	Broadcast		Broadcast	Broadcast	
July 23	July 17		July 23	July 17		July 23	July 30	
July 23	July 17		July 23	July 17		July 23	July 30	
July 25	July 21		July 25	July 21		July 25	Aug. 9	
150	150		170½	180		202	150	
60	80		73½	78		84	62	

8.			9.			10.		
Sub-soil plow for corn, Michigan for wheat.			Common plow.			Sub-soil plow for corn, Michigan for wheat.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Fallow.	Fallow.		Oats	Oats		Oats	Oats	
			April 21	April 26		April 23	April 26	
			Broadcast	Broadcast		Broadcast	Broadcast	
			July 23	July 30		July 23	July 30	
			July 23	July 30		July 23	July 30	
			July 25	Aug. 9		July 28	Aug. 9	
			201	200		200	250	
			83	87		81	96	

13.			14.			15.		
Sub-soil plow for corn, Michigan for wheat; butt grain.			Common plow; end grain.			Sub-soil plow for corn, Michigan for wheat; end grain.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Oats	Oats		Oats	Oats		Oats	Oats	
April 23	April 26		April 23	April 26		April 23	April 26	
Broadcast	Broadcast		Broadcast	Broadcast		Broadcast	Broadcast	
July 23	July 30		July 23	July 30		July 23	July 30	
July 23	July 30		July 23	July 30		July 23	July 30	
July 28	Aug. 9		July 28	Aug. 9		July 28	Aug. 9	
207	210		208	210		218	200	
83	92		83½	76		87	85	

18.			19.			20.		
Corn, sub-soil plow; wheat, Michigan plow; lime, 50 bush. per acre.			Common plow; lime, 100 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 100 bush. per acre.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Oats	Oats		Oats	Oats		Oats	Oats	
April 23	April 26		April 23	April 26		April 23	April 26	
Broadcast	Broadcast		Broadcast	Broadcast		Broadcast	Broadcast	
July 23	July 30		July 23	July 30		July 23	July 30	
July 23	July 30		July 23	July 30		July 23	July 30	
July 28	Aug. 9		July 23	Aug. 9		July 27	Aug. 9	
214	170		210	210		226	200	
91	79		90	72		101	90	

FIRST TIER OF PLOTS.

Rotation of crops.	Number of plot	21.			22.		
	Treatment	Common plow; lime, 200 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 200 bushels per acre.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Oats.	Oats.		Oats.	Oats.	
	When planted	April 23.	April 26.		April 23.	April 26.	
	How planted	Broadcast.	Broadcast.		Broadcast.	Broadcast.	
	When matured	July 23.	July 30.		July 23.	July 30.	
	When cut	July 23.	July 30.		July 23.	July 30.	
	When housed	July 27.	Aug. 9.		July 27.	Aug. 9.	
	Product, straw	179.	250.		206¼	170.	
	Product, grain	85.	95.		91¼	86.	
	Page of report						

Rotation of crops.	Number of plot	26.			27.		
	Treatment	Corn, sub-soil plow: wheat, Michigan plow; lime, none.			Nitrate of soda.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Oats.	Oats.		Oats.	Oats.	
	When planted	April 23.	April 26.		April 23.	April 26.	
	How planted	Broadcast.	Broadcast.		Broadcast.	Broadcast.	
	When matured	July 23.	July 30.		July 23.	July 30.	
	When cut	July 23.	July 30.		July 23.	July 30.	
	When housed	July 27.	Aug. 9.		July 27.	Aug. 9.	
	Product, straw	196.	195.		170.	130.	
	Product, grain	96.	61.		81.	69.	
	Page of report						

Rotation of crops.	Number of plot	31.			32.		
	Treatment	Ground bone.			Bone superphosphate.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Oats.	Oats.		Oats.	Oats.	
	When planted	April 22.	April 26.		April 22.	April 26.	
	How planted	Broadcast.	Broadcast.		Broadcast.	Broadcast.	
	When matured	July 23.	July 30.		July 23.	July 30.	
	When cut	July 23.	July 30.		July 23.	July 30.	
	When housed	July 27.	Aug. 9.		July 27.	Aug. 9.	
	Product, straw	227.	150.		244.	95.	
	Product, grain	105.	72.		115.	57.	
	Page of report						

Rotation of crops.	Number of plot	36.			37.		
	Treatment	Common plow; clover plowed down.			Sub-soil plow for corn; Michigan for wheat; timothy plowed down.		
Year		1875.			1875.		
Oats and barley.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Oats.			Oats.	
	When planted		April 26.			April 26.	
	How planted		Broadcast.			Broadcast.	
	When matured		July 30.			July 30.	
	When cut		July 30.			July 30.	
	When housed		Aug. 9.			Aug. 9.	
	Product, straw		105.			150.	
	Product, grain		67.			66.	
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

FIRST TIER OF PLOTS.

23.			24.			25.		
Seed wheat and barley, 1 bus.; corn, 3 stalks every 3 feet; rows 4 feet apart; clover and timothy, 4 qts			Seed wheat and barley, 2 bus.; corn, 1 stalk at 12 inches; rows, 4 feet apart; clover and timothy, 6 qts.			Lime, none.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Oats.....	Oats.....	.....	Oats.....	Oats.....	.....	Oats.....	Oats.....	.....
April 23....	April 26...	.....	April 23...	April 26...	.....	April 23...	April 26...	.....
Broadcast .	Broadcast	.....	Broadcast	Broadcast	.....	Broadcast	Broadcast	.....
July 23.....	July 30....	.....	July 23....	July 30....	.....	July 23....	July 30....	.....
July 23.....	July 30....	.....	July 23....	July 30....	.....	July 23....	July 30....	.....
July 27.....	Aug. 9	.....	July 27....	Aug. 9	.....	July 27....	Aug. 9	.....
212½.....	200.....	.....	223.....	190.....	.....	223.....	220.....	.....
94½.....	83.....	.....	100.....	80.....	.....	103.....	80.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

28.			29.			30.		
No manure.			Sulphate of ammonia.			Barnyard manure.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Oats.....	Oats.....	.....	Oats.....	Oats.....	.....	Oats.....	Oats.....	.....
April 23....	April 26...	.....	April 23...	April 26...	.....	April 23...	April 26...	.....
Broadcast .	Broadcast	.....	Broadcast	Broadcast	.....	Broadcast	Broadcast	.....
July 23.....	July 30....	.....	July 23....	July 30....	.....	July 23....	July 30....	.....
July 23.....	July 30....	.....	July 23....	July 30....	.....	July 23....	July 30....	.....
July 27.....	Aug. 9	.....	July 27....	Aug. 9	.....	July 27....	Aug. 9	.....
164½.....	135.....	.....	175.....	140.....	.....	234.....	80.....	.....
74½.....	77.....	.....	80.....	86.....	.....	109.....	64.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

33.			34.			35.		
Mineral superphosphate.			Night soil.			Sub-soil plow for corn, Michigan for wheat; clover plowed down.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Oats.....	Oats.....	.....	Oats.....	Oats.....	.....	.....	Oats.....	.....
April 23....	April 26...	.....	April 22...	April 26...	.....	.....	April 26...	.....
Broadcast .	Broadcast	.....	Broadcast	Broadcast	.....	.....	Broadcast	.....
July 23.....	July 30....	.....	July 23....	July 30....	.....	.....	July 30....	.....
July 23.....	July 30....	.....	July 22....	July 30....	.....	.....	July 30....	.....
July 27.....	Aug. 9	.....	July 27....	Aug. 9	.....	.....	Aug. 9	.....
248.....	150.....	.....	277.....	150.....	.....	.....	200.....	.....
118.....	75.....	.....	127.....	87.....	.....	.....	70.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

38.		
Common plow; timothy plowed down.		
1875.		
Eastern.	Central.	Western.
.....	Oats.....	.....
.....	April 26...	.....
.....	Broadcast	.....
.....	July 30....	.....
.....	July 30....	.....
.....	Aug. 9	.....
.....	136.....	.....
.....	90.....	.....
.....	.....	.....

SECOND TIER OF PLOTS.

Rotation of crops.							
	Number of plot	101.			102.		
	Treatment	Common plow.			Sub-soil plow for corn, Michigan for wheat.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Jennings			Jennings	
	When planted		Sept. 5, '74,			Sept. 5, '74,	
	How planted					Drilled	
	When matured		July 13			July 13	
	When cut		July 13			July 13	
	When housed		July 17			July 17	
	Product, straw		220			215	
	Product, grain		64			65	
	Page of report						

Rotation of crops.							
	Number of plot	106.			107.		
	Treatment	Sub-soil plow for corn, Michigan for wheat.			Common plow.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Jennings			Jennings	
	When planted		Sept. 5, '74,			Sept. 5, '74,	
	How planted		Drilled			Drilled	
	When matured		July 13			July 13	
	When cut		July 13			July 13	
	When housed		July 17			July 17	
	Product, straw		370			280	
	Product, grain		84			90	
	Page of report						

Rotation of crops.							
	Number of plot	111.			112.		
	Treatment	Sub-soil plow for potatoes, Michigan for wheat.			Common plow; butt grain.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Jennings			Jennings	
	When planted		Sept. 5, '74,			Sept. 5, '74,	
	How planted		Drilled			Drilled	
	When matured		July 13			July 13	
	When cut		July 13			July 13	
	When housed		July 17			July 17	
	Product, straw		200			350	
	Product, grain		70			62	
	Page of report						

Rotation of crops.							
	Number of plot	116.			117.		
	Treatment	Sub-soil and Michigan plows; alternate years.			Common plow; lime, 50 bushels per acre.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Potatoes			Jennings	
	When planted		May 15,			Sept. 5, '74,	
	How planted		Drills			Drilled	
	When matured		Oct. 11			July 13	
	When cut					July 13	
	When housed		Oct. 13			July 17	
	Product, straw		½ l & w, 400			280	
	Product, grain		½ cut, 370			81	
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

SECOND TIER OF PLOTS.

103.	104.	105.
Common plow.	Sub-soil plow for corn, Michigan for wheat.	Common plow.
1875.	1875.	1875.
Eastern. / Central. / Western.	Eastern. / Central. / Western.	Eastern. / Central. / Western.
Jennings.	Jennings.	Jennings.
Sept. 5, '74.	Sept. 5, '74.	Sept. 5, '74.
Drilled.	Drilled.	Drilled.
July 13.	July 13.	July 13.
July 13.	July 13.	July 13.
July 17.	July 17.	July 17.
210.	340.	370.
81.	110.	108.

108.	109.	110.
Sub-soil plow for corn, Michigan for wheat.	Common plow.	Sub-soil plow for corn, Michigan for wheat.
1875.	1875.	1875.
Eastern. / Central. / Western.	Eastern. / Central. / Western.	Eastern. / Central. / Western.
Jennings.	Jennings.	Jennings.
Sept. 5, '74.	Sept. 5, '74.	Sept. 5, '74.
Drilled.	Drilled.	Drilled.
July 13.	July 13.	July 13.
July 13.	July 13.	July 13.
July 17.	July 17.	July 17.
390.	220.	330.
97.	82.	101.

113.	114.	115.
Sub-soil plow for corn, Michigan for wheat; butt grain.	Common plow; end grain.	Sub-soil plow for corn, Michigan for wheat; end grain.
1875.	1875.	1875.
Eastern. / Central. / Western.	Eastern. / Central. / Western.	Eastern. / Central. / Western.
Jennings.	Jennings.	Jennings.
Sept. 5, '74.	Sept. 5, '74.	Sept. 5, '74.
Drilled.	Drilled.	Drilled.
July 13.	July 13.	July 13.
July 13.	July 13.	July 13.
July 17.	July 17.	July 17.
240.	240.	220.
70.	80.	72.

118.	119.	120.
Corn, sub-soil plow; wheat, Michigan plow; lime, 50 bus. per acre.	Common plow; lime, 100 bushels per acre.	Corn, sub-soil plow; wheat, Michigan plow; lime, 100 bus. per acre.
1875.	1875.	1875.
Eastern. / Central. / Western.	Eastern. / Central. / Western.	Eastern. / Central. / Western.
Jennings.	Jennings.	Jennings.
Sept. 5, '74.	Sept. 5, '74.	Sept. 5, '74.
Drilled.	Drilled.	Drilled.
July 13.	July 13.	July 13.
July 13.	July 13.	July 13.
July 17.	July 17.	July 17.
280.	300.	270.
66.	91.	75.

SECOND TIER OF PLOTS.

Rotation of crops.							
	Number of plot	121.			122.		
	Treatment	Common plow; lime, 200 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 200 bushels per acre.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Jennings			Jennings	
	When planted		Sept. 5, '74,			Sept. 5, '74,	
	How planted		Drilled			Drilled	
	When matured		July 13.			July 13.	
	When cut		July 13.			July 13.	
	When housed		July 17.			July 17.	
	Product, straw		320.			224.	
	Product, grain		99.			69.	
	Page of report						

Rotation of crops.							
	Number of plot	126.			127.		
	Treatment	Corn, sub-soil plow; wheat, Michigan plow; lime, none.			Nitrate of soda.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Wheat.	Jennings		Wheat.	Jennings	
	When planted	Sept. 28	Sept. 5, '74,		Sept. 28	Sept. 5, '74,	
	How planted	Drilled	Drilled		Drilled	Drilled	
	When matured	July 9.	July 13.		July 9.	July 13.	
	When cut	July 10.	July 13.		July 10.	July 13.	
	When housed	July 15.	July 17.		July 15.	July 17.	
	Product, straw	460.	180.		447½	160.	
	Product, grain	142.	61.		152.	49.	
	Page of report						

Rotation of crops.							
	Number of plot	131.			132.		
	Treatment	Ground bone.			Bone superphosphate.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Wheat.	Jennings		Wheat.	Jennings	
	When planted	Sept. 23	Sept. 5, '74,		Sept. 18	Sept. 5, '74,	
	How planted	Drilled	Drilled		Drilled	Drilled	
	When matured	July 9.	July 13.		July 9.	July 13.	
	When cut	July 10.	July 13.		July 9.	July 13.	
	When housed	July 15.	July 17.		July 15.	July 17.	
	Product, straw	444.	130.		440¼	200.	
	Product, grain	159.	75.		185¼	67.	
	Page of report						

Rotation of crops.							
	Number of plot	136.			137.		
	Treatment	Common plow; clover plowed down.			Sub-soil plow for corn, Michigan for wheat; timothy plowed down.		
Year		1875.			1875.		
Wheat.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Jennings			Jennings	
	When planted		Sept. 5, '74,			Sept. 5, '74,	
	How planted		Drilled			Drilled	
	When matured		July 13.			July 13.	
	When cut		July 13.			July 13.	
	When housed		July 17.			July 17.	
	Product, straw		460.			340.	
	Product, grain		131.			128.	
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

SECOND TIER OF PLOTS.

123.			124.			125.		
Seed wheat and barley, 1 bus.; corn, 3 stalks every 3 feet, rows 4 feet apart; clover and timothy, 4 qts.			Seed wheat and barley, 3 bus.; corn, 1 stalk at 12 inches, rows 4 feet apart; clover and timothy, 4 qts.			Lime, none.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Wheat	Jennings		Wheat	Jennings		Wheat	Jennings	
Sept. 28	Sept. 5, '74		Sept. 28	Sept. 5, '74		Sept. 28	Sept. 5, '74	
Drilled	Drilled		Drilled	Drilled		Drilled	Drilled	
July 9	July 13		July 9	July 13		July 9	July 13	
July 10	July 13		July 10	July 13		July 10	July 13	
July 15	July 17		July 15	July 17		July 15	July 17	
428¼	320		545	230		450	250	
108½	90		125	78		140	71	

126.			129.			130.		
No manure.			Sulphate of ammonia.			Barn-yard manure.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Wheat	Jennings		Wheat	Jennings		Wheat	Jennings	
Sept. 28	Sept. 5, '74		Sept. 28	Sept. 5, '74		Sept. 28	Sept. 5, '74	
Drilled	Drilled		Drilled	Drilled		Drilled	Drilled	
July 9	July 13		July 9	July 13		July 9	July 13	
July 10	July 13		July 10	July 13		July 10	July 13	
July 15	July 17		July 15	July 17		July 15	July 17	
408	260		500¼	270		570	160	
148	101		160½	90		170	75	

132.			134.			135.		
Mineral superphosphate.			Night soil.			Sub-soil plow for corn, Michigan for wheat; clover plowed down.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Wheat	Jennings		Wheat	Jennings			Jennings	
Sept. 18	Sept. 5, '74		Sept. 18	Sept. 5, '74			Sept. 5, '74	
Drilled	Drilled		Drilled	Drilled			Drilled	
July 9	July 13		July 9	July 13			July 13	
July 9	July 13		July 9	July 13			July 13	
July 15	July 17		July 15	July 17			July 17	
272	350		320	400			340	
187	109		160	194			114	

133.
Common plow; timothy plowed down.
1875.

Eastern.	Central.	Western.
	Jennings	
	Sept. 5, '74	
	Drilled	
	July 13	
	July 13	
	July 17	
	470	
	126	

THIRD TIER OF PLOTS.

Rotation of crops.	Number of plot	201.			202.		
	Treatment	Common plow.			Sub-soil plow for corn, Michigan for wheat.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	Clover		Grass	Clover	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 25			June 25		
	When cut	June 26	June 28		June 26	June 28	
	When housed	June 29	June 29		June 29	June 29	
	Product, hay	270	190		250	210	
	Product						
	Page of report						

Rotation of crops.	Number of plot	206.			207.		
	Treatment	Sub-soil plow for corn, Michigan for wheat.			Common plow.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	Clover		Grass	Clover	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 25			June 25		
	When cut	June 26	June 28		June 26	June 28	
	When housed	June 29	June 29		June 29	June 29	
	Product, hay	240	200		255	180	
	Product						
	Page of report						

Rotation of crops.	Number of plot	211.			212.		
	Treatment	Sub-soil plow for potatoes, Michigan for wheat.			Common plow; butt grain.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	C. and T.		Grass	C. and T.	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 29			June 29		
	When cut	June 29	June 28		June 29	June 28	
	When housed	June 30	June 29		June 30	June 29	
	Product, hay	24	140		340	150	
	Product						
	Page of report						

Rotation of crops.	Number of plot	216.			217.		
	Treatment	Sub-soil and Michigan plows alternate years.			Common plow; lime, 50 bus. to the acre.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Potatoes		Grass	C. and T.	
	When planted		May 15		March, '74.		
	How planted		Drilled		Sown.		
	When matured		Oct. 11		June 29		
	When cut				June 29	June 28	
	When housed		Oct. 13		June 30	June 29	
	Product, hay		½ 1 & w 400		202	160	
	Product		½ s & w 400				
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

THIRD TIER OF PLOTS.

203.			204.			205.		
Common plow.			Sub-soil plow for corn, Michigan for wheat.			Common plow.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	Timothy..	.....	Grass.....	Timothy..	.....	Grass.....	Clover....	.....
Sept. 25, '73.	.....	.....	Sept. 25, '73	.....	.....	Mar., '74.	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 25....	.....	.....	June 25...	.....	.....	June 25...	.....	.....
June 26....	June 28..	.....	June 28...	June 28...	.....	June 28...	June 28..	.....
June 29....	June 29..	.....	June 29...	June 29...	.....	June 29...	June 29..	.....
280.....	170.....	.....	195.....	100.....	.....	210.....	210.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

208.			209.			210.		
Sub-soil plow for corn, Michigan for wheat.			Common plow.			Sub-soil plow for corn, Michigan for wheat.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	Clover....	.....	Grass.....	C. and T..	.....	Grass.....	C. and T..	.....
March, '74.	.....	.....	March, '74	.....	.....	March, '74	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 25....	.....	.....	June 25...	.....	.....	June 29...	.....	.....
June 26....	June 28..	.....	June 28...	June 28...	.....	June 29...	June 28..	.....
June 29....	June 29..	.....	June 29...	June 29...	.....	June 30...	June 29..	.....
215.....	150.....	.....	245.....	230.....	.....	235.....	160.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

213.			214.			215.		
Sub-soil plow for corn, Michigan for wheat; butt grain.			Common plow; end grain.			Sub-soil plow for corn, Michigan for wheat; end grain.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	C. and T..	.....	Grass.....	C. and T..	.....	Grass.....	C. and T..	.....
March, '74.	.....	.....	March, '74	.....	.....	March, '74	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 29....	.....	.....	June 29...	.....	.....	June 29...	.....	.....
June 29....	June 28..	.....	June 29...	June 28...	.....	June 29...	June 28..	.....
June 30....	June 29..	.....	June 30...	June 29...	.....	June 30...	June 29..	.....
216.....	200.....	.....	190.....	150.....	.....	212.....	180.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

218.			219.			220.		
Corn, sub-soil plow; wheat, Michigan plow; lime, 50 bus. per acre.			Common plow; lime, 100 bus. per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 100 bus. per acre.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	C. and T..	.....	Grass.....	C. and T..	.....	Grass.....	C. and T..	.....
March, '74.	.....	.....	March, '74	.....	.....	March, '74	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 29....	.....	.....	June 29...	.....	.....	June 29...	.....	.....
June 29....	June 28..	.....	June 29...	June 28...	.....	June 29...	June 28..	.....
June 30....	June 29..	.....	June 30 ..	June 29...	.....	June 30...	June 29..	.....
218.....	180.....	.....	195.....	150.....	.....	203.....	100.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

THIRD TIER OF PLOTS.

Rotation of crops.	Number of plot	221.			222.		
	Treatment	Common plow; lime, 200 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 200 bushels per acre.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	C. and T.		Grass	C. and T.	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 29.			June 29.		
	When cut	June 29.	June 28.		June 29.	June 28.	
	When housed	June 30.	June 29.		June 30.	June 29.	
	Product, hay	245.	120.		243.	150.	
	Product						
	Page of report						

Rotation of crops.	Number of plot	226.			227.		
	Treatment	Corn, sub-soil plow; wheat, Michigan plow; lime, none.			Nitrate of soda.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	C. and T.		Grass	C. and T.	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 29.			June 29.		
	When cut	June 29.	June 28.		June 29.	June 28.	
	When housed	June 30.	June 29.		June 30.	June 29.	
	Product, hay	178.	220.		110.	170.	
	Product						
	Page of report						

Rotation of crops.	Number of plot	231.			232.		
	Treatment	Ground bone.			Bone superphosphate.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Grass	C. and T.		Grass	C. and T.	
	When planted	March, '74.			March, '74.		
	How planted	Sown.			Sown.		
	When matured	June 29.			June 29.		
	When cut	June 29.	June 28.		June 29.	June 28.	
	When housed	June 30.	June 29.		June 30.	June 29.	
	Product, hay	300.	215.		208.	300.	
	Product						
	Page of report						

Rotation of crops.	Number of plot	236.			237.		
	Treatment	Common plow; clover plowed down.			Sub-soil plow for corn; Michigan for wheat; timothy plowed down.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Left on ground			Left on ground	
	When planted						
	How planted						
	When matured						
	When cut						
	When housed						
	Product, hay						
	Product						
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

THIRD TIER OF PLOTS.

223.			224.			225.		
Seed wheat and barley, 1 bu.; corn, 3 stalks every 3 feet, rows 4 feet apart; clover and timothy, 4 qts.			Seed wheat and barley, 2 bus.; corn, one stalk at 12 inches, rows 4 feet apart; clover and timothy, 6 qts.			Lime, none.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	C. and T..	.....	Grass.....	C. and T..	.....	Grass.....	C. and T..	.....
March, '74.	.....	.....	March, '74.	.....	.....	March, '74.	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 29....	.....	.....	June 29..	.....	.....	June 29...	.....	.....
June 29....	June 28..	.....	June 29..	June 28..	.....	June 29...	June 28..	.....
June 30....	June 29..	.....	June 30..	June 29..	.....	June 30...	June 29..	.....
180.....	180.....	.....	228.....	230.....	.....	200.....	180.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

228.			229.			230.		
No manure.			Sulphate of ammonia.			Barn-yard manure.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	C. and T..	.....	Grass.....	C. and T..	.....	Grass.....	C. and T..	.....
March, '74.	.....	.....	March, '74.	.....	.....	March, '74.	.....	.....
Sown.....	.....	.....	Sown.....	.....	.....	Sown.....	.....	.....
June 29....	.....	.....	June 29..	.....	.....	June 29...	.....	.....
June 29....	June 28..	.....	June 29..	June 28..	.....	June 29...	June 28..	.....
June 30....	June 29..	.....	June 30..	June 29..	.....	June 30...	June 29..	.....
98.....	170.....	.....	226.....	170.....	.....	187.....	220.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....

233.			234.			235.		
Mineral superphosphate.			Night soil.			Sub-soil plow for corn, Michigan for wheat; clover plowed down.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Grass.....	C. and T..	.....	Grass.....	C. and T..	.....	.....	Left on ground	.....
March, '74.	.....	.....	March, '74.	.....	.....	.....		.....
Sown.....	.....	.....	Sown.....	.....	.....	.....		.....
June 29....	.....	.....	June 29..	.....	.....	.....		.....
June 29....	June 28..	.....	June 29..	June 28..	.....	.....		.....
June 30....	June 29..	.....	June 30..	June 29..	.....	.....		.....
255.....	200.....	.....	253.....	220.....	.....	.....		.....
.....	.....	.....	.....	.....	.....	.....		.....
.....	.....	.....	.....	.....	.....	.....		.....

238.		
Common plow; timothy plowed down.		
1875.		
Eastern.	Central.	Western.
.....	Left on ground	.....
.....		.....
.....		.....
.....		.....
.....		.....
.....		.....
.....		.....
.....		.....

FOURTH TIER OF PLOTS.

Rotation of crops.							
	Number of plot	301.			302.		
	Treatment	Common plow.			Sub-soil plow for corn, Michigan for wheat.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Clover			Clover	
	When planted						
	How planted						
	When matured						
	When cut		June 23			June 23	
	When housed		June 25			June 25	
	Product, hay		270			210	
	Product						
	Page of report						

Rotation of crops.							
	Number of plot	306.			307.		
	Treatment	Sub-soil plow for corn, Michigan for wheat.			Common plow.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Clover			Clover	
	When planted						
	How planted						
	When matured						
	When cut		June 23			June 23	
	When housed		June 25			June 25	
	Product, hay		135			140	
	Product						
	Page of report						

Rotation of crops.							
	Number of plot	311.			312.		
	Treatment	Sub-soil plow for potatoes, Michigan for wheat.			Common plow; butt grain.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		C. and T.			C. and T.	
	When planted						
	How planted						
	When matured						
	When cut		June 23			June 22	
	When housed		June 25			June 25	
	Product, hay		200			200	
	Product						
	Page of report						

Rotation of crops.							
	Number of plot	316.			317.		
	Treatment	Sub-soil and Michigan plows; alternate years.			Common plow; lime, 50 bushels per acre.		
Year		1875.			1875.		
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Potatoes			C. and T.	
	When planted		May 15.				
	How planted		Drills				
	When matured		Oct. 11.				
	When cut					June 23	
	When housed		Oct. 13.			June 25	
	Product, hay		½ l & w 990,			300	
	Product		½ s & w 790,				
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

FOURTH TIER OF PLOTS.

303.			304.			305.		
Common plow.			Sub-soil plow for corn, Michigan for wheat.			Common plow.		
1875.			1875.			1875.		
Eastern.	Central. Timothy.	Western.	Eastern.	Central. Timothy.	Western.	Eastern.	Central. Clover	Western.
	June 23			June 23			June 23	
	June 25			June 25			June 25	
	220.			180.			180.	

306.			309.			310.		
Sub-soil plow for corn, Michigan for wheat.			Common plow.			Sub-soil plow for corn, Michigan for wheat.		
1875.			1875.			1875.		
Eastern.	Central. Clover	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.
	June 23			June 23			June 23	
	June 25			June 25			June 25	
	135.			200.			210.	

312.			314.			315.		
Sub-soil plow for corn, Michigan for wheat; butt grain.			Common plow; end grain.			Sub-soil plow for corn, Michigan for wheat; end grain.		
1875.			1875.			1875.		
Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.
	June 23			June 23			June 23	
	June 25			June 25			June 25	
	210.			210.			215.	

318.			319.			320.		
Corn, sub-soil plow; wheat, Michigan plow; lime, 50 bus. per acre.			Common plow; lime, 100 bushels per acre			Corn, sub-soil plow; wheat, Michigan plow; lime, 100 bus. per acre.		
1875.			1875.			1875.		
Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.
	June 23			June 23			June 23	
	June 25			June 25			June 25	
	200.			200.			310.	

FOURTH TIER OF PLOTS.

Rotation of crops.								
	Number of plot	321.			322.			
	Treatment	Common plow; lime, 200 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 200 bushels per acre.			
Year		1875.			1875.			
Clover & timothy.	Name of farm	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	
	Variety							
	When planted							
	How planted							
	When matured							
	When cut		June 23			June 23		
	When housed		June 25			June 25		
	Product, hay		380			280		
	Product							
	Page of report							

Rotation of crops.								
	Number of plot	326.			327.			
	Treatment	Corn, sub-soil plow; wheat, Michigan plow; lime, none.			Nitrate of soda.			
Year		1875.			1875.			
Clover & timothy.	Name of farm	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	
	Variety							
	When planted							
	How planted							
	When matured							
	When cut		June 22			June 22		
	When housed		June 25			June 25		
	Product, hay		320			320		
	Product							
	Page of report							

Rotation of crops.								
	Number of plot	331.			332.			
	Treatment	Ground bone.			Bone superphosphate.			
Year		1875.			1875.			
Clover & timothy.	Name of farm	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	
	Variety							
	When planted							
	How planted							
	When matured							
	When cut		June 24			June 23		
	When housed		June 29			June 29		
	Product, hay		280			200		
	Product							
	Page of report							

Rotation of crops.								
	Number of plot	336.			337.			
	Treatment	Common plow; clover plowed down.			Sub-soil plow for corn, Michigan for wheat; timothy plowed down.			
Year		1875.			1875.			
Clover & timothy.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.	
	Variety		Left on ground.			Left on ground.		
	When planted							
	How planted							
	When matured							
	When cut							
	When housed							
	Product, hay							
	Product							
	Page of report							

EXPERIMENTAL FARMS—CONTINUED.

FOURTH TIER OF PLOTS.

322.			324.			325.		
Seed wheat and barley, 1 bus.; corn, 3 stalks every 3 feet; rows 4 feet apart; clover and timothy, 4 qts			Seed wheat and barley, 3 bus.; corn, 1 stalk at 12 inches; rows, 4 feet apart; clover and timothy, 6 qts.			Lime, none.		
1875.			1875.			1875.		
Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.
	June 23			June 23			June 23	
	June 25			June 25			June 25	
	320			360			325	

328.			329.			330.		
No manure.			Sulphate of ammonia.			Barnyard manure.		
1875.			1875.			1875.		
Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.
	June 23			June 23			June 23	
	June 29			June 29			June 29	
	280			280			280	

333.			334.			335.		
Mineral superphosphate.			Night soil.			Sub-soil plow for corn, Michigan for wheat; clover plowed down.		
1875.			1875.			1875.		
Eastern.	Central. C. and T.	Western.	Eastern.	Central. C. and T.	Western.	Eastern.	Central.	Western.
							Left on ground.	
	June 23			June 23				
	June 29			June 29				
	200			160				

338.		
Common plow; timothy plowed down.		
1875.		
Eastern.	Central.	Western.
	Left on ground.	

FIFTH TIER OF PLOTS.

Rotation of crops.	Number of plot	401.			402.		
	Treatment	Common plow.			Sub-soil plow for corn, Michigan for wheat.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Corn			Corn		
	When planted	May 7	May 13		May 7	May 13	
	How planted	Drilled			Drilled		
	When matured	Sept. 25			Sept. 25		
	When cut	Sept. 25	Sept. 21		Sept. 25	Sept. 21	
	When housed	Oct. 28	Oct. 21		Oct. 28	Oct. 21	
	Product, corn	810	620		815	620	
	Product, fodder	500	400		501	347	
	Page of report						

Rotation of crops.	Number of plot	406.			407.		
	Treatment	Sub-soil plow for corn, Michigan for wheat.			Common plow.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Corn			Corn		
	When planted	May 7	May 13		May 7	May 13	
	How planted	Drilled			Drilled		
	When matured	Sept. 25			Sept. 25		
	When cut	Sept. 25	Sept. 21		Sept. 25	Sept. 21	
	When housed	Oct. 28	Oct. 21		Oct. 28	Oct. 21	
	Product, corn	760	590		800	610	
	Product, fodder	489	330		491	380	
	Page of report						

Rotation of crops.	Number of plot	411.			412.		
	Treatment	Sub-soil plow for potatoes, Michigan for wheat.			Common plow; butt grain.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Climax	Potatoes		Corn	Corn	
	When planted	Potatoes			May 7	May 13	
	How planted	May 10	May 15		Drilled		
	When matured	Hoed in			Sept. 25	Sept. 21	
	When cut	Sept. 1	Oct. 11		Sept. 25		
	When housed	Oct. 28	Oct. 13		Oct. 28	Oct. 21	
	Product, corn	¼ l & w 400 ¼ m & w 408	¼ l & w 400 ¼ m & w 340		800	510	
	Product, fodder	¼ s & w 420 ¼ cut 380	¼ s & w 320 ¼ cut 340		492	290	
	Page of report						

Rotation of crops.	Number of plot	416.			417.		
	Treatment	Sub-soil and Michigan plows, alternate years.			Common plow; lime, 50 bushels per acre.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Early Rose	Potatoes		Corn	Corn	
	When planted	May 12	May 15		May 7	May 13	
	How planted	Hills			Drilled		
	When matured	Aug. 27	Oct. 11		Sept. 25		
	When cut				Sept. 25	Sept. 21	
	When housed		Oct. 13		Oct. 28	Oct. 21	
	Product, corn	½ large 710, ½ small 640,	960		730	580	
	Product, fodder				470	380	
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

FIFTH TIER OF PLOTS.

403. Common plow. 1875.			404. Sub-soil plow for corn, Michigan for wheat. 1875.			405. Common plow. 1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn			Corn			Corn		
May 7	May 13		May 7	May 13		May 7	May 13	
Drilled			Drilled			Drilled		
Sept. 25			Sept. 25			Sept. 25		
Sept. 25	Sept. 21		Sept. 25	Sept. 21		Sept. 25	Sept. 21	
Oct. 28	Oct. 21		Oct. 28	Oct. 21		Oct. 28	Oct. 21	
780	520		800	520		775	515	
460	325		490	265		467	360	

408. Sub-soil plow for corn, Michigan for wheat. 1875.			409. Common plow. 1875.			410. Sub-soil plow for corn, Michigan for wheat. 1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn			Corn			Corn		
May 7	May 13		May 7	May 13		May 7	May 13	
Drilled			Drilled			Drilled		
Sept. 25			Sept. 25			Sept. 25		
Sept. 25	Sept. 21		Sept. 25	Sept. 21		Sept. 25	Sept. 21	
Oct. 28	Oct. 21		Oct. 28	Oct. 21		Oct. 28	Oct. 21	
785	540		790	600		800	565	
463	300		495	350		490	360	

413. Sub-soil plow for corn, Michigan for wheat; butt grain. 1875.			414. Common plow; butt grain. 1875.			415. Sub-soil plow for corn, Michigan for wheat; end grain. 1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn			Corn			Corn		
May 7	May 13		May 7	May 13		May 7	May 13	
Drilled			Drilled			Drilled		
Sept. 25			Sept. 25			Sept. 25		
Sept. 25	Sept. 21		Sept. 25	Sept. 21		Sept. 25	Sept. 21	
Oct. 28	Oct. 21		Oct. 28	Oct. 21		Oct. 28	Oct. 21	
770	525		860	560		735	570	
485	300		509	300		470	240	

418. Corn, sub-soil plow; wheat, Michigan plow; lime, 80 bush. per acre. 1875.			419. Common plow; lime, 100 bushels per acre. 1875.			420. Corn, sub-soil plow; wheat, Michigan plow; lime, 100 bush. per acre. 1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn			Corn			Corn	Corn	
May 7	May 13		May 7	May 13		May 7	May 13	
Drilled			Drilled			Drilled		
Sept. 25			Sept. 22			Sept. 22		
Sept. 25	Sept. 21		Sept. 22	Sept. 21		Sept. 22	Sept. 21	
Oct. 28	Oct. 22		Oct. 28	Oct. 22		Oct. 28	Oct. 22	
700	540		735	565		740	520	
465	280		471	350		473	350	

FIFTH TIER OF PLOTS.

Rotation of crops.	Number of plot	421.			422.		
	Treatment	Common plow; lime, 200 bushels per acre.			Corn, sub-soil plow; wheat, Michigan plow; lime, 200 bushels per acre.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Corn	Corn		Corn	Corn	
	When planted	May 7	May 13		May 7	May 13	
	How planted	Drilled			Drilled		
	When matured	Sept. 22			Sept. 22		
	When cut	Sept. 22	Sept. 21		Sept. 22	Sept. 21	
	When housed	Oct. 28	Oct. 22		Oct. 28	Oct. 22	
	Product, corn	695	450		535	510	
	Product, fodder	462	300		507	330	
	Page of report						

Rotation of crops.	Number of plot	426.			427.		
	Treatment	Corn, sub-soil plow; wheat, Michigan plow; lime, none.			Nitrate of soda.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Corn	Corn		Corn	Corn	
	When planted	May 7	May 13		May 7	May 13	
	How planted	Drilled			Drilled		
	When matured	Sept. 22			Sept. 21		
	When cut	Sept. 22	Sept. 22		Sept. 22	Sept. 21	
	When housed	Oct. 28	Oct. 28		Oct. 28	Oct. 22	
	Product, corn	725	450		670	370	
	Product, fodder	487	200		467	220	
	Page of report						

Rotation of crops.	Number of plot	431.			432.		
	Treatment	Ground bone.			Bone superphosphate.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety	Corn	Corn		Corn	Corn	
	When planted	May 7	May 13		May 7	May 13	
	How planted	Drilled			Drilled		
	When matured	Sept. 23			Sept. 23		
	When cut	Sept. 23	Sept. 21		Sept. 23	Sept. 21	
	When housed	Oct. 28	Oct. 23		Oct. 28	Oct. 23	
	Product, corn	755	340		868	310	
	Product, fodder	490	140		510	92	
	Page of report						

Rotation of crops.	Number of plot	436.			437.		
	Treatment	Common plow; clover plowed down.			Sub-soil plow for corn, Michigan for wheat; timothy plowed down.		
Year		1875.			1875.		
Corn.	Name of farm	Eastern.	Central.	Western.	Eastern.	Central.	Western.
	Variety		Corn			Corn	
	When planted		May 13			May 13	
	How planted						
	When matured						
	When cut		Sept. 21			Sept. 21	
	When housed		Oct. 23			Oct. 23	
	Product, corn		520			500	
	Product, fodder		110			120	
	Page of report						

EXPERIMENTAL FARMS—CONTINUED.

FIFTH TIER OF PLOTS.

423.			424.			425.		
Seed wheat and barley, 1 bus.; corn, 3 stalks every 3 feet, rows 4 feet apart; clover and timothy, 4 qts.			Seed wheat and barley, 3 bus.; corn, 1 stalk every 12 inches, rows 4 feet apart; clover and timothy, 6 qts.			Lime, none.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn	Corn		Corn	Corn		Corn	Corn	
May 7	May 13		May 7	May 13		May 7	May 13	
Hoed			Hoed			Drilled		
Sept. 22			Sept. 22			Sept. 22		
Sept. 22	Sept. 21		Sept. 22	Sept. 21		Sept. 22	Sept. 21	
Oct. 28	Oct. 22		Oct. 28	Oct. 22		Oct. 28	Oct. 22	
649	500		690	450		695	500	
460	290		474	210		477	290	

426.			429.			430.		
No manure.			Sulphate of ammonia.			Barn-yard manure.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn	Corn		Corn	Corn		Corn	Corn	
May 7	May 13		May 7	May 13		May 7	May 13	
Drilled			Drilled			Drilled		
Sept. 23			Sept. 23			Sept. 23		
Sept. 23	Sept. 21		Sept. 23	Sept. 21		Sept. 23	Sept. 21	
Oct. 28	Oct. 23		Oct. 28	Oct. 23		Oct. 28	Oct. 28	
620	350		590	350		845	275	
460	150		434	135		502	140	

433.			434.			435.		
Mineral superphosphate.			Night soil.			Sub-soil plow for corn, Michigan for wheat; clover plowed down.		
1875.			1875.			1875.		
Eastern.	Central.	Western.	Eastern.	Central.	Western.	Eastern.	Central.	Western.
Corn	Corn		Corn	Corn			Corn	
May 7	May 13		May 7	May 13			May 13	
Drilled			Drilled					
Sept. 23			Sept. 23					
Sept. 23	Sept. 21		Sept. 23	Sept. 21			Sept. 21	
Oct. 28	Oct. 22		Oct. 28	Oct. 23			Oct. 28	
736	415		815	440			625	
491	120		502	122			125	

438.		
Common plow; timothy plowed down.		
1875.		
Eastern.	Central.	Western.
	Corn	
	May 13	
	Sept. 21	
	Oct. 23	
	510	
	120	

SECOND ANNUAL REPORT

OF

TRANSACTIONS OF THE

PENNSYLVANIA
STATE DAIRYMEN'S ASSOCIATION,

INCLUDING

ADDRESSES AND DISCUSSIONS, FOR THE YEAR 1876.

OFFICERS OF THE ASSOCIATION.

PRESIDENT.

A. M. FULLER, Meadville.

SECRETARY.

H. COOLEY GREEN, Meadville.

CORRESPONDING SECRETARY.

J. M. BIGGER, Cambridge.

TREASURER.

I. R. HALL, Randolph.

VICE PRESIDENTS.

JOSEPH BLYSTONE, Venango.
WM. PORTER, Chapinville.
W. W. POWER, Conneautville.
WM. MORSE, New Richmond.
L. L. LAMB, Townville.
A. B. WASNER, Sugar Lake.
A. S. BEATTY, Shaw's Landing.
S. J. LOGAN, Hartstown.
JOHN COLE, Crossingville.
S. REEDER, Edinboro'.
R. H. ARBUCKLE, Erie.
D. W. TITUS, Phillipsville, Erie county.
Hon. WM. BENSON, Waterford, Erie county.
T. C. COCHRAN, Sheakleyville, Mercer county.
J. W. M'CONNELL, Milledgeville, Mercer county.
E. W. HAMILTON, Cherrytree, Venango county.
O. C. HOPKINS, Pleasantville, Venango county.
Hon. L. D. WETMORE, Warren.
Hon. M. LEECH, Greenville, Mercer.
S. E. KINCAID, Wayne, Erie county.

CONSTITUTION.

Adopted April 15, 1871. Amended January 9, 1874, June 3, 1874, and December 29, 1875.

SECTION 1. This organization shall be called the Pennsylvania Dairymen's Association.

SECTION 2. Its purpose shall be to improve the dairy interests of Pennsylvania.

SECTION 3. Its members shall consist of such persons as shall pay the sum of one dollar annually, and of honorary members.

SECTION 4. The payment of five dollars shall constitute a paid up life membership.

SECTION 5. The officers of the association shall consist of a president, twenty vice presidents, a secretary, a treasurer, and a corresponding secretary. These, excepting vice presidents, shall constitute the executive board, and shall have the general oversight of the affairs of the association, the appointment of its meetings, and all arrangements for the same.

SECTION 6. The annual meeting for the election of officers shall be held on the last Wednesday of each year, at such place as may be designated by the executive board.

SECTION 7. It shall be the duty of the secretary to keep and prepare for publication the transaction of all meetings each current year, embracing such papers as shall be approved by the executive board. It shall be the duty of the treasurer to keep and disburse the funds of the association on the order of the secretary, countersigned by the president, and to report receipts and expenditures at the annual meeting. It shall be the duty of the corresponding secretary to do the corresponding, and assist the executive board in whatever work they make think proper.

SECTION 8. Amendments to this constitution may be made at any annual meeting by a two-thirds vote of the members present.

HONORARY MEMBERS.

Prof. J. Tingley, Allegheny College, Meadville.
Rev. A. B. Hyde, D. D., Meadville.
Rev. W. F. Day, D. D., Meadville.
Rev. Wm. Young, D. D., Meadville.
Rev. J. G. Carnachan, D. D., Meadville.
E. A. Hempstead, Meadville.
Cyrus Kitchen, Esq., Meadville.
Jas. E. M'Farland, Meadville.
J. H. Lenhart, Meadville.
Col. S. B. Dick, Meadville.
M. P. Davis, Esq., Meadville.
H. Foster.
Prof. L. B. Arnold, Rochester, N. Y.

LIST OF MEMBERS.

Amidon, L. H., Rundells.
Allee, J. W., Saegertown.
Baldwin, C. E., Nelson, Ohio.
Bently, G., Randolph.
Bentram, H. D., Little Cooley.
Blystone, Joseph, Venango.
Blystone, P., Venango.
Blystone, J. H., Edinboro'.
Blystone, W. J., Venango.
Baumbach, J., Shaw's Landing.
Breckenridge, S., Meadville.
Beatty, A. D., Meadville.
Beatty, A. S., Shaw's Landing.
Bigger, J. M., Cambridge.
Birchard, W. B., Woodcock Borough.
Breckenridge, A. S., Meadville.
Brawley, F., Meadville.
Brooks, S. B., Union City.
Cole, John, Venango.
Cochran, Thos., Sheakleyville.
Calvin, R. A., Sheakleyville.
Coroden, J. S., New Richmond.
Canfield, H., Millers.
Carringer, H. E., Cambridge.
Crossley, E. D., Hayfield.
Cannon, Austin, New Richmond.
Canfield, J., Mill Village.
Carroll, G. W., Union City.
Delamater, L., Guys.
Dean, W. W., Cochranton.
Drennen, W. F., Philadelphia.
Dunn, W. G., Coon's Corners.
Dean, H., Cochranton.
Dibble, A. J., Franklin, Delaware co., N. Y.
Davison, A. H., Blooming Valley.
Edmonds, M. L., Mill Village.
Edmonds, F. W., Dunkirk, N. Y.
Ferry, R. C., Venango.
Farrington, S. A., Cambridge.
Fuller, A. M., Meadville.
Fuller, J. D., Harmonsburg.
Fish, G. A., Lenox, O.
Findley, Hon. S. H., Atlantic.
Greene, H. Cooley, Meadville.
Greene, O. B., Meadville.
Gilbert, W. N., Guys.
Giddings, L. R., Venango.
Griggs, E. D., Blooming Valley.
Gernly, D., Cochranton.
Gifford, W. E., Jamestown, N. Y.
Gibson, D. H., Woodcock Borough.
Griffith, S. B., Low Center, Cattaraugus co., N. Y.
Hall, J. E., Randolph.
Hall, S. R., Randolph.
Hazen, F. M., Venango.
Hammon, H. C., Dicksonsburg.
Hosmer, Wm. S., Meadville.
Harper, A. E., Meadville.
Harper, S. R., Meadville.
Harper, Myron, Meadville.
Harper, D. D., Meadville.
Hoyt, W. A., Randolph.

Hazen, B. G., Venango.
Hazen, B. G., Jr., Venango.
Haggerty, D., Dicksonburg.
Hastings, L. A., Waterford.
Irons, J. W., Pleasantville.
Johnston, J. W., Cambridge.
Jackson, R. C., Phillipsville.
Jones, J., Guys.
King, H. C., Spring.
Kincaid, S. E., Wayne, Erie county.
Logan, M., Sheakleyville.
Middaugh, A., Friendship, Cattaraugus co., N. Y.
Miller, L. W., Stockton, N. Y.
Morse, Wm., Richmond.
Monroe, P. P., Guys.
M'Guire, H., Conneautville.
Matson, S., Plum.
M'Quiston, L., Atlantic.
Marley, H. P., Shaws.
Middleton, Geo., Waterford.
Nodim, D. H., Cochranton.
Nodim, C. F., Cochranton,
Nash, Wm., Crossingville.
Obitts, N. H., Elyria, O.
Ograin, J. J., Harthegig.
Perry, C. J.
Payne, C. N., Conneaut, O.
Porter, Wm., Chapinville.
Pond, W. L., Spring.
Perry, P. O., Edinboro'.
Perry, A., Edinboro'.
Payne, N. S., Conneautville.
Price, A., Sheakleyville.
Purse, G. F., Meadville.
Root, E. S., Cambridge.
Root, S. F., Cambridge.
Robinson, J. B., Harmonsburg.
Robinson, A. C., Jamestown, N. Y.
Rabel, A. M., Woodcock.
Rogers, A. P., Cadiz, N. Y.
Reeder, H. W., Erie.
Reeder, J. C., Edinboro'.
Reynolds, E. A., Jr., Meadville.
Shontz, E. M., Evansburg.
Sadler, H. J., Mecca, O.
Sellew, C. B., Meadville.
Sweeny, O. B., Harmony, N. Y.
See, A. J., Evansburg.
Shreve, D., Union City.
Titus, W. B., Phillipsville, Erie county.
Terry, M. H., Waterford.
Thompson, Wm., Sugar Lake.
Titus, D. D., Phillipsville.
Utley, E. W., Randolph.
Watson, W. H., Hayfield.
Weller, A. J., Shaw's Landing.
Wheeler, C. M., Lebouff, Erie county.
White, W. N.
Waldo, R. J., Conneautville.
Wire, T. B., Lenox, O.
Waters, D., Cochranton.
Warren, L., Richmond Centre, O.
White, T. W., Union City.
Waite, W. R., Union City.
Wilcox, Geo., Millers.

INTRODUCTORY.

To the numerous readers of this volume, the secretary hereby presents the second published annual report of the transactions of the Pennsylvania Dairymen's Association.

It is hoped that its perusal will be found, both entertaining and instructive to a discerning and reflective public.

We are well aware that the reading dairymen of America—and this includes all dairymen worthy of the name—are not only discerning and reflective, but in an important sense criticising also.

It is therefore not without misgivings that its compilation and arrangement has been undertaken by one little used to work of this kind.

As the title page indicates, several of the papers treat intelligently upon subjects of the highest importance to progressive dairymen, and we feel assured that in this respect this report will suffer nothing when placed side by side with those of other and older societies.

Its preparation has been in the midst of abundant labors and cares, and it is not mere formality to ask the indulgence of our more critical readers for any errors of arrangement or other editorial imperfections it may contain.

The object arrived at has been to put matter of practical utility into a tolerably readable shape.

HISTORY OF DAIRYING IN NORTH-WESTERN PENNSYLVANIA.

The five counties, occupying the extreme north-western corner of the State, Warren, Venango, Mercer, Crawford and Erie, constitute the dairying portion of Western Pennsylvania. The surface of Erie county along the Lake Shore is level, and soil sandy, becomes rolling, arid with heavier soil at a distance of 10 to 15 miles.

Crawford, Mercer, Venango and Warren counties would be classed as hilly. The hard woods, beech, maple and oak, interspersed with basswood, white wood, cucumber, ash and elm, constitute the bulk of the forests, though there are considerable tracts of pine and hemlock. The country is bountifully supplied with streams of water, most of which are tributaries of French Creek, and Oil Creek, the waters of which find their way to the Gulf, through the Allegheny, Ohio and Mississippi rivers.

These streams are formed and fed by the numerous springs, with which the country is wonderfully favored, and to which in a large degree the dairymen owe their prosperity.

In former years, the leading occupation of the farmers was the raising of stock which was driven over the mountains to Philadelphia. The driving of cattle and boating of lumber to Pittsburg was the variety of employments of a large portion of the middle aged, and young men. These avocations are now nearly obsolete. The railroad has abolished the one, and the diminished supply of timber together with the shrinkage of the streams, incident to clearing up the country, the other. Many people at the east when speaking of Western Pennsylvania are very apt to associate with it the idea of a new country, little settled, and still less improved. The facts are, however, that the central counties of New York have to-day as great a proportion of timber land, and not more extensive modern improvements than are found in these counties.

Gradually it became apparent that the great west was about to supersede the eastern sections in supplying seaboard cities with beef, and as gradually the people turned their attention to other branches of husbandry. Some tried sheep, and for a time were prospered, but fluctuating prices and the many ills the sheep is heir to proved disheartening, and the poor sheep are compelled to "vamoose the ranche," and make room for the cow.

Until quite recently the ancient custom very generally prevailed, of giving the care of the cows, calves and chickens into the hands of the wives and daughters of the household The proceeds of the cow and hen dairies constituting their pin money.

This practice relieved the men and boys of a very important and wholesome responsibility to their own damage, for in proportion as they were freed from thought and care for the dairy they were rendered incompetent to pursue the business profitably in after years, and in many instances the later tuition has been somewhat expensive.

As the people were not versed in the subtle arts of butter and cheese making, the products of their herds were not of a high order, and only here and there a family met with success indicating any special adaptation of climate, soil, or grass to the production of fine butter or cheese.

Yet nature had done her part, and only time and its train of events were wanting to bring man to the discovery, and prompt him to the development of her abundant resources.

President A. M. Fuller has written this brief account of the early movements in this direction.

"The first attempt at factory cheese making was made about the year 1849, at Mosiertown, under the superintendence of Messrs. Clark and Stebbins, manufacturing what was styled English dairy cheese, in weight about sixteen pounds, and selling at three cents per pound. It differed from the present system, in that the patrons delivered curd instead of milk.

The second factory was also built in Mosiertown in 1851, by Mosier and M'Farland, and continued in operation for three years, when this system of factory cheese making came to an end."

In subsequent years there existed in the northern portion of Crawford county several large private dairies, notably those of D. D., W. B. and Cyrus Birchard, numbering from 20 to 40 cows. The cheese from these dairies, much of it found a market in the adjoining counties, and at encouraging prices, having a range of from five to thirteen cents per pound.

The tide of dairy progress which originating in Herkimer county, New York, about forty years ago, and passing into Oneida county, developed there into the present factory system, sweeping westward and southward over the central, southern and western counties, reached Crawford county about 1870, when there were four factories in the county.

These being under good financial management served to arouse a degree of interest among the people, and to form the nucleus around which others were soon established, and they now form the geographical center of a group of more than 100 factories within a radius of about 25 miles.

The extent of the business here is compactly stated in the following paragraph, also from Prest. Fuller, who, in response to the toast, "our guests,"

at the banquet, gave in the course of his remarks the following concise and interesting statement of the importance of the dairy interest in this section.

"The dairy interest which we, as citizens, have the honor of entertaining to-night is represented in this section by 101 factories, giving employment to 300 operators, and furnishes the main income of 5,000 of our farmers. These factories are supplied with the milk of 30,000 cows, aggregating 96,000,000 pounds of milk, from which is produced 9,600,000 pounds of cheese, or in other words 160,000 boxes, or 500 car loads, the total value of which is one million of dollars."

In the year 1871, the writer of this sketch, with the co-operation of Joseph Blystone, Esq., of Venango, and D. H. Gibson, of Woodcock Borough, issued a call for a meeting of factory proprietors and dairymen, to organize a dairymen's association.

The organization was effected, Joseph Blystone, Esq., was made president, and D. H. Gibson, secretary, with a membership of about fifteen.

The business was new, the system new, and regarded as an experiment, the interest in organized effort low, and as a matter of course progress was made slowly.

The meetings for discussion were thinly attended, and it soon became apparent that the free horse must take the load—in other words, that, while the dairymen were chiefly and most directly and permanently to be benefited by success of the society, and whatever progress might result from its efforts to spread intelligence among the people, they were wanting in zeal and preferred that the factorymen should bear their burdens for them.

Thus, those who were determined to "work that they might win," were compelled to carry the institution and keep up the interest as best they could.

After a time at the suggestion of present president, A. M. Fuller, a new effort was made to rouse dairymen to action, to secure their attendance and co-operation at the meetings.

The secretary obtained the name and address of every factory patron possible, and sent out to each man, personal circulars, 2,700 in number, announcing the meetings and the programmes.

This method of advertising, though rather expensive, proved a success, and while the "charter members" have redoubled their energies, and all have made a united effort, the association has, it is believed, done much and is destined to do much more to raise the standard of quality, and enhance the value of the products of the dairy, while striving to secure the greater intelligence of the dairyman and his family, in everything that relates, even remotely to the success of his calling.

One of the tangible results of these efforts is the organization of the Pennsylvania Dairymen's Board of Trade, which was effected in the spring of 1875, with a patronage of 55 factories, and having its headquarters at Meadville.

This city is a central point for shipment, convenient of access from all parts of this dairy section. Shipping facilities are good, and with a half dozen banks through which to effect exchange.

The advantages afforded to factories for keeping themselves posted on the market value of their products and securing fair prices have been highly appreciated.

A distinguishing feature of this board of trade is the discussions had during the first hour of each session upon topics relating to manufacture and sale of dairy goods. These associated efforts have become a necessity in every dairy center, and have greatly modified and improved the methods of cheese sales.

TRANSACTIONS.

ANNUAL MEETING, HELD AT MEADVILLE, DEC. 29 AND 30, 1875.

The convention was called to order by President Fuller, at eleven A. M. No business of importance was transacted other than the appointment of committees.

Afternoon Session.

At two P. M. the committee on amending the constitution reported a revision of the articles of association.

The treasurer read his report, showing the expenses for the past year to have been $341 28; receipts, $301 50, leaving a balance of indebtedness of $39 78, exclusive of the cost of providing for the present meeting.

William Porter, first vice president, then took the chair during the reading of the annual address by the president, on the Present and Future of the Dairy Interest of Pennsylvania.

At the close of the address remarks were made by several members, the speakers strongly supporting the position taken by the president, when J. M. Bigger offered the following resolution, which passed:

Resolved, That the president be requested to appoint a committee to report on a plan for co-operative action among factories, the better to secure the interests of both factories and patrons.

W. F. Drenner, general agent for J. H. Reall & Co., read a letter from Mr. Reall, touching upon various points of interest to dairymen, and expressing his compliments to the association.

L. W. Miller, of Stockton, N. Y., delivered an address on meal feeding, taking substantially the same ground as in his elaborate address of one year ago, and giving details of still further experiments during the past season, all going to prove the correctness of his peculiar theory of exclusive meal feeding.

This address was followed by numerous questions by members on minor points, to all of which the speaker replied as fully as time would permit.

Mr. F. Blanchard expressed a desire to have this theory tested by a greater number of dairymen than it has yet been, and under a greater variety of circumstance.

If the theory eventually proves to be what Mr. Miller believes it to be, his name, as its first advocate, will be handed down to future generations with great favor.

In answer to questions, the speaker stated that he is buying no cows to re-stock his diary, but depends entirely upon calves of his own raising, which are wintered upon exclusive meal diet. He keeps his cows closely in stanchions, and finds it favorable to their condition.

SECOND DAY.

MORNING SESSION, 9:30 A. M.

The number in attendance this morning at the opening was somewhat less than it should have been, many numbers being rather dilatory, being engaged, as is usually the case on such occasions, in private conversations, each endeavoring to draw from somebody such practical information he most feels the need of. While these conversations tend to delay the regular business of the convention, they are at the same time a feature of dairymen's conventions of inestimable value.

DISCUSSIONS FROM THE QUERY BOX.

Question. Will Mr. Baldwin tell us whether the full blooded Durham cow is good for milk and for dairy purposes?

Mr. Baldwin. I intended to be understood last evening as saying that without she possesses the points of excellence enumerated in my address, the cow of whatever breed cannot be relied on as a milker. In other words, breed alone is not a sure guarantee of milking qualities.

Question. Will milk twenty-four hours old make as much curd as new milk?

Prof. Arnold. There is no good reason why it will not, if no cream has been removed, and if it be properly preserved. The age of milk, or as cheesemakers say, its maturity, has much to do with its manufacture, as the germs of ferment develop in the curd more or less rapidly according to the maturity of the milk.

New milk is not adapted to making fine cheese when used unmixed with that of a previous milking. Its tendency is to make a soft, porous cheese with no fine flavor.

Question. What can be done to secure a respectable exhibit of cheese at the Centennial?

Prof. Arnold stated that there was a call for a general convention of delegates from all the dairy organizations in the country to consider the matter of the Centennial, and I would recommend that this Association appoint at least two delegates to that convention.

It is proposed to erect a cheese factory upon the Centennial grounds, and the space for such buildings has been granted. In this factory cheese are to be made daily during at least a portion of the season, the object of this convention will be in part to provide means for operating this factory.

Mr. Wire. It seems to me that the cheese retailed from such a factory might produce a profit which would go far towards paying expenses.

The circular issued by the Centennial Committee of the A. D. A., appealing to dairymen for contributions for a fund to carry forward this object was read by the President.

The evening hour was taken up by the address of Mr. C. E. Baldwin, on *Breeding and Selecting Dairy Cattle.*

After which the convention having been presented with free tickets retired to Shryock's Hall to partake of a banquet tendered by the business men of Meadville, of which the following account was given in the *Daily Republican:*

THE DAIRYMEN'S BANQUET.

Few banquets have ever been held in this city, that passed off with more *eclat* than the banquet, complimentary to the Dairymen's Association from the business men of Meadville, given Wednesday, at Shryock's hall. Immediately after adjournment of the evening session of the Association at the Court House the members and their friends repaired to Shryock's hall, and there met Meadville's representative men, who extended them the hospitality of the city. The welcome they received was most gratifying. It was not a welcome savoring of formality and reserve, but it was a gathering characterized by real friendship.

Between three and four hundred partook of the feast bountifully and richly spread under the direction of H. T. Colt.

There were three tables extending the full length of the hall handsomely decorated, and upon the centre table was placed an immense cheese.

After the enjoyment of the excellent supper came the intellectual feast which kept every one in the very best of humor until a late hour, the speeches being interspersed with music by the North Western Band.

The banquet was presided over by the mayor of the city, M. Park Davis, who made a brief address, followed by a brief reply by the president, A. M. Fuller. "The dairymen from abroad" was responded to by Prof. L. B. Arnold, of Rochester, N. Y.; F. Blanchard, president Western New York Dairy Association; Cornelius Baldwin, of Ohio; L. W. Miller, Chautauqua county, N. Y., and Hon. James Sheakley. "The dairymen of Crawford county" was responded to by Ira Hall, of Randolph; Wm. Jones and W. M. Nash, of Crossingville; H. C. Green, of Meadville; Col. O. O. Potter, of Potter's Corners; S. A. Farrington, of Cambridge, and Hon. S. H. Findley. The "Press" was replied to by Col. Tyler, who spoke in behalf of the press of Crawford county; R. T. Jackson, of the Erie *Gazette,* in behalf of Erie county. Mr. Redding, of the *Rural New Yorker,* was also called upon and responded briefly. The following gentlemen, representing

the city, contributed to enliven the occasion with excellent remarks: Col. S. B. Dick, Dr. Hyde, Rev. George Meyer, Pearson Church, Esq., Harry Foster, Cyrus Kitchen, Esq., Thomas Roddy, Esq., Hon. George B. Delamater.

THURSDAY MORNING.

The first hour was spent in discussion, when the convention listened to an address by Col. Potter, on "*Grass.*"

This address was followed by a brief discussion on the policy of leaving aftermath to decay upon the surface of the meadow, and also on the merits of white clover as compared with other grasses.

Mr. Arnold. I have been a close observer of the different grasses as cheese producing grasses. I do not regard any of the clovers as first-class pasturage. White clover is best of all clovers, but in my opinion not equal to pure grass, or redtop, or timothy grass, for the production of fine butter or cheese. It does not produce in milk that flavor or aroma, so desirable in these products.

The remaining hour of the session was occupied by the address of Prof. L. B. Arnold, on the "*Secretion of Milk,*" which was listened to with intense interest.

The subject was profusely illustrated with drawings showing the appearance of tainted and diseased milk under the microscope, and other essential points in the address, including a representation of the cow's udder with milk cells or cavities which contain the milk and showing how it enters, passes through and escapes from the udder into the teat, how the cow "holds up" her milk, and how it is involuntarily retained in the udder.

Afternoon Session.

Election of officers.

Reports of committees being in order, the following reports were made:

ON DAIRY IMPLEMENTS.

Mr. President.—Your committee would report that there has been a liberal display of implements applicable to dairy purposes, all of which possess real merits.

The swinging cattle stanchion was represented by a full sized model. It possesses features that recommend it for general dairy use, being adapted to the comfort of cattle and convenient to use. Each stanchion is independent of all others, hung at the top and swing forward at the bottom as the animal rises to its feet, thus obviating the straining that cows are subjected to in the fixed stanchion. They are self closing and fastening.

The space for the neck can be quickly adjusted to animals of different sizes. We regard them as worthy the consideration of dairymen and all keepers of cattle.

H. J. Sadler, of Mecca, Ohio, exhibited the "cow fetter," which stiffens the hock joint, and prevents the cow from lifting her foot upward or putting it forward in her attempts to kick.

Also your attention is called to the "Common Sense Milk Pan and Cooler," for making butter in farm dairying, manufactured by Elliott & Oakes, Cattaraugus, N. Y.

A. G. Dibble, Franklin, Delaware county, New York, exhibited a butter worker whereby the butter can be washed, weighed and worked without being removed from the worker. We think it shows the result of much good thought, and recommend it to the use of dairymen.

Alvin Middaugh, of Friendship, Allegheny county, New York, exhibits a novel plan by which he can work up the samples of patrons' milk separately, thereby practically testing its comparative quality.

Hannan and Obitts, Elyria, Ohio, exhibit a model of a self-heating cheese vat, which seems to possess some good features.

Elliot Oakes, Cattaraugus county, New York, exhibits the Common Sense Milk Pan and Cooler—a plan for setting milk deep and cooling at the sides, bottom and centre.

D. H. GIBSON, *Chairman*.

ON PLAN FOR AVOIDING THE EVILS OF THE FACTORY SYSTEM.

We, your committe, appointed to draw up a plan for the purpose of more firmly uniting the factorymen in their operations and creating a better feeling between factorymen and patrons, recommend.

1st. That factorymen buy no milk unless they buy all.

2d. That factorymen use no undue influence to induce patronage of their respective factories, except by striving to make a superior article, and by that means alone.

3d. That manufacturing on the percentage plan is the true plan of conducting factories, subject to the wishes of the majority of the patrons, whether they adopt the percentage plan or having their milk manufactured at a stated price.

WM. MORSE,
H. CANFIELD,
WM. NASH.

ON DAIRY PRODUCTS.

Your committee find the samples are indicative of a very favorable section for the production of a high grade of cheese. They are all, without

exception, of great excellence, possessing fine flavor, fine texture, and are fine throughout, tender, rich, and easily digestible, having none of that dryness characteristic of some sections of the country. One of the committee declared that if he were to choose from the samples shown he would as soon choose by lot as by inspection, so nearly equal were they in quality.

The samples on exhibition were marked Gibson, Hall, Nash.

L. B. ARNOLD,
FLINT BLANCHARD,
Committee.

Following the reports of committees was the address by Flint Blanchard, on "Dairy spectacles."

The hour drawing near for the departure of the afternoon trains, many members were obliged to retire before the exhibition of some samples of the chemical products of milk obtained by Mr. Sorenson, chemist for Callender & Co.

At the same time a brief but highly interesting paper was read by Mr. P. A. Laffer, descriptive of the nature and peculiar properties and uses of the substances exhibited.

Resolutions of thanks were tendered to the citizens and business men of Meadville for the many proofs of their good will and co-operation with dairymen, as evinced by daily intercourse, by the rich banquet provided at their expense, and the accompanying words of greeting and congratulation.

To the speakers for their entertaining and instructive addresses, and to Mr. P. A. Laffer, for the presentation of samples of chemical elements of milk, and the accompanying explanatory address.

Thus closed one of the most profitable and pleasant sessions of the association. The weather being warm and pleasant, resembling that of April or May more than the last of December, while it was favorable to the comfort and enjoyment of those present, rendered the roads exceedingly muddy and unfavorable to the attendance of those dairymen who must come a great distance by wagon road, thus materially reducing the receipts for membership fees as well as the number in attendance.

THE PRESENT AND FUTURE OF THE DAIRY INTEREST OF PENNSYLVANIA.

BY A. M. FULLER, PRESIDENT.

AN ADDRESS DELIVERED BEFORE THE ASSOCIATION AT MEADVILLE, PA., DECEMBER 29, 1875.

GENTLEMEN:—It is pleasant indeed to again meet under such favorable circumstances, and with so large a representation of those engaged directly in the production or manufacture of dairy products.

We believe this occasion to be a time particularly suited to the presentation of a brief review of the progress and success attained during the past season, and also for a discussion of the demands and needs of the interest for the coming year. We believe that our gathering together at this time will prove not only of interest, but will result in great benefits and tend to increase the desire for a more thorough and searching investigation into the more recent developments and best approved practices of the dairy business.

In this progressive age, and particularly in view of the fact that at no time in the history of trade has competition ruled so strongly, or the necessity seemed so apparent for intelligent action, and a close scrutiny into the causes which produce results, a thorough knowledge of which will alone enable us to mitigate, if not prevent the recurrence of those evils attendant upon over-production of dairy products. We believe by studying more closely the causes which have in some cases produced unsatisfactory results the past season, we may in future, by avoiding those things which experience has proven to be prejudicial, and by adopting what we believe to be better plans and practices, place this important industry on a more certain and enduring basis. It is an unpleasant thought, but we believe nevertheless true, that in the pursuance of most branches of business and manufacture, success in the coming years, if attained, will be accomplished, not so much by any intrinsic merit of the business as by the skill and foresight of the management; hence, we would urge upon dairymen not to allow others to outstrip us in this respect, but rather let us devote more thought, and adopt those practices, which if persisted in will inure to our benefit, and the permanency of this interest.

Dairymen have accomplished much during the past year in the advancement and tendency towards the further development of the dairy interests

of North-western Pennsylvania, and we may point with pardonable pride to the success which has attended all the meetings of the association—the successful advent of the board of trade, the improved transportation facilities granted at the request of the association, and still more to the increasing desire and determination to place the reputation of this State, as a superior dairy section, on a firmer and better basis. But we must not overlook the fact that we have scarcely as yet emerged from our swaddling clothes, and before attempting to walk as men, we must, perhaps by an unpleasant experience, conquer much that is yet new to us, and which, until accomplished, will not place us on an equal footing with eastern dairymen.

Several important points have been prepared for your consideration at this time, applicable to both factorymen and patrons, and are introduced, not with a view to criticise, but with the hope that they may suggest some action on your part, and evoke discussion on matters which we believe to be of the most vital importance to those engaged in the dairy business. The first point we desire to present, and one more particularly interesting to factorymen, is this: Cannot factorymen combine to a sufficient extent, and do away with the unprofitable and disastrous rivalry which now exists between factories? We believe this to be the great bane of the present management, and an evil which, if persisted in, threatens to demoralize the interest in this section. Certainly interests are identical, and the more we combine and work for the general good, the greater profit will we impart to the interest, and reap a corresponding benefit as individuals.

You may ask, how can we cure this evil? We would reply,

BUY NO MILK.

This we believe to be the only remedy for the evil. The buying of milk from a portion of the patrons of a factory, in the first place, even though a source of profit to the manufacturer, a result, however, which has not been general the past season, does not tend to that confidence in the management which is the guarantee of success; and secondly, we believe it engenders and is the main cause of the ill feeling which now exists between many factories and factorymen. Again, if factorymen will buy milk, in preference to the other plan, we would suggest, buy all your manufacture, but in the plan adopted by factories east, based on the ruling price of cheese, as it may be on the first of each month; this relieves the factoryman from a speculative investment, and ensures to the patron the true value of his product. We believe this matter to be worthy of attention on the part of factorymen, and that the adoption of some plan that would prove satisfactory to all very desirable.

Secondly. We think factorymen should also combine to a sufficient extent to protect themselves and their patrons from the possibility of their receiving for manufacture impure or adulterated milk. For instance, if a dairymen who has formerly patronized a neighboring factory, and becomes dissatisfied, would apply for admission to your factory, the cause of his so doing should be ascertained, and if on account of the improper care or quality of his milk, we believe there should be such an understanding among factorymen, as would debar him from the privilege of another factory.

Thirdly A point which factorymen will have eventually to meet, is

THE PRICE FOR MANUFACTURING.

The discussion of this subject at the present time, may be looked upon by some as premature, but we believe there is nothing to be gained by beating around the bush, and that we can present an argument upon this point that will explain, though it may not prove acceptable to the majority, the spirit in which this matter should be met. Many patrons argue that the factorymen are receiving too great a compensation for their investment and labor. It was thought by the inexperienced a few years since that it was only necessary to invest a few thousand dollars in a factory, put the milk in one end and dollars would run out of the other. We believe a majority of the factorymen find this to be an exploded theory, and that actual experience has rather proven the reverse to be true. Patrons should consider that an investment of this kind is constantly depreciating in value, and demanding frequently additional expenditures in the way of repairs, while the patrons' returns though seemingly small in comparison, are rendered far more desirable, when we take into consideration the indirect benefit they receive, in the increased productiveness and value of their farms. Again, when you refer to other sections as a precedent the fact must not be overlooked, that owing to their long experience in the business they have adopted that management in the receiving of milk at the factories, which entails little expense on the part of the manufacturer, while our factorymen at the present time pay fully twenty per cent. to their patrons for the delivery of milk; also, that factories manufacturing at a low rate are generally supported by a large patronage. What factoryman would not prefer to manufacture the milk of 600 cows at $1 50 per hundred, rather than the milk of 300 cows at $2 00 per hundred? And further, by allowing the factoryman a fair compensation for his investment and labor, you enable him to employ the most experienced help, and provide the best materials needed in manufacturing, hence, we would say to patrons do not adopt that course which will result in the production of an inferior quality of goods, but allow the manufacturer a fair return for his labor and investment.

We have now presented several points applicable to factorymen, and desire to refer briefly to some matters more directly affecting the patron's interest.

First in regard to

THE APPOINTMENT OF SALESMEN.

In a majority of the factories under the present system, at the spring meeting for organization, the patrons elect a committee of patrons to act as salesmen, a salesman with an assistant, by a committee of patrons, this we do not believe to be the most approved plan. The less number of salesmen in a factory the better. We would suggest the appointment of your best man, relying solely upon his judgment, and accepting his action as conclusive. If he does not prove acceptable appoint another in his stead. Do not exact entire freedom from mistakes from any man, but remember that neither individuals nor committees are infallible. One man who devotes thought and study to the state of the market, and follows closely its fluctuations, will be more likely to arrive at correct conclusions, and effect sales with greater satisfaction and more intelligently than a committee of salesmen, or even with the aid of an assistant.

We find the salesmen who consults their patrons most are the most undecided when they meet the buyer. It is natural for the average patron to insist upon a better price for their cheese than it is worth, in most cases resulting in the salesman holding the cheese when he should sell. We believe a majorities of the factories East adopt this plan and finds it proves advantageous, and we believe the interests of this section would be benefited by adopting it.

Secondly, in reference to

THE SALE OF CHEESE.

It is an acknowledged fact that the Board of Trade furnishes the best means for disposing of our product. The transactions for the past year have not proved as satisfactory as they might, from the fact that the market was constantly on the decline, and the salesmen unprepared and, in most cases, entirely unacquainted with the workings of such an organization. Let it be the reverse, and you will find the advantages of a Board of Trade will increase ten-fold. Many salesmen did not avail themselves of its full advantages the past season, selling, in some cases, previous to its meetings, and invariably at no better price, and many times at a less price than could have been obtained on the Board. The advantages of a full knowledge of the state of the market, and the opportunity of meeting a number of buyers, afford salesmen the best protection that can be obtained.

Salesmen should consider that the more cheese they can offer at a given sale, letting buyers understand it is for sale only that time, the more competition will it create among buyers, and have a tendency to attract a larger number to this market. Some factory men claim they do not perceive its advantages. We do not ask them to blindly endorse what they do not fully comprehend, but would simply ask them what interest is there that has attained any magnitude or prominence, but has its Board of Trade? There is scarcely a city in the Union, of forty thousand inhabitants, that has not its Board of Trade connected with some important industry. It is generally adapted as a necessary adjunct to the proper management of large interests. We believe it can be no less a necessity to the interests which we control, and we would here state, emphatically, that a Board of Trade is not a panacea for all the difficulties that attend the business, but proves valuable only in proportion as salesmen co-operate, unite and work as one man.

In regard to the representation of factories on the Board, a few words may not be amiss. The sum necessary to defray the expenses of telegrams and incidental expenses, requires a membership fee of three dollars to each factory. The salesman is not known as a member unless he chooses to become such, but the factory he represents, in the name of the factory; hence, each factory at its first meeting for organization, should instruct its salesman to become a member of the Board of Trade at the expense of the factory. In several cases one party is salesman for several factories, and as no factory, unless properly represented, is allowed to be sold on the Board, it behooves each factory to see that it is properly represented.

Intimately connected with this subject, the sale of cheese, is the time at which the product should be disposed of. We believe it holds good with this, as with other farm products, when it is ready for market—move it. The season of 1874 was a peculiar one and one not likely to be repeated. The salesmen who held for better prices generally obtained them, not owing to any foresight on their part, however, but because it happened to prove so. The true policy is, no doubt, to move it as it becomes ready for market, if a fair market price is offered, thereby avoiding both loss by shrinkage and loss in flavor, which must be the result if the cheese is held any length of time, and we believe the adoption of such a policy as likely to prove more satisfactory to patrons.

Thirdly, we believe this to be the most important matter we have to bring before you.

HOW SHALL WE ESTABLISH A REPUTATION FOR PENNSYLVANIA CHEESE?

We would answer: brand it. We have been engaged in the manufacture of cheese but a few years, and yet, owing to the superior quality of

our production, we have been enabled to obtain prices that will compare favorably with those received by the best and most highly favored dairy sections of the country. We have far outstripped our neighbors of the Western Reserve, and are bound eventually to attain the highest rank as a dairy section, but yet we are a section with virtually no reputation. Three-fourths of our product is to-day sold as New York State cheese, the balance being credited as Pennsylvania or Western cheese. The attainment of a reputation is now within our reach, and it remains to be seen whether we shall stand out boldly and assert our right, or cloak ourselves under the reputation of another. You may ask what advantage it will be to us to establish a distinctive reputation. We reply: Suppose a manufacturer of any class of goods places his product on the market and sells it on the reputation of a well-known manufacturer, he cannot obtain the same price, so long as there is an adequate supply of the genuine goods, presuming his goods to be of equal value. Again, suppose he brands his goods, he cannot at first obtain the price received by an established and well known brand, but his goods being of equal merit, eventually he will establish a reputation which will redound to his benefit, and, whatever may be the condition of the trade in general, he will always find a ready market for his product. With us, our cheese is selling very nearly on a par with the best. Hence, if we establish a reputation, distinctive and local, we shall not only at all times find ready sale, but secure prices more in accordance with the true value of our products. The high prices obtained by special factories on the Little Falls and Utica Boards of Trade, are merely the result of these factories, having by the uniform excellency of their product, and by branding their goods, given them a distinctive reputation, and we believe the factories in this section that first adopt this plan, in connection with the manufacture of a superior article of cheese, will eventually reap the greater benefit. One word in regard to the maintaining of our reputation. In this section during the past season we have manufactured upwards of nine million pounds of cheese—almost exclusively whole milk cheese. We would consider it an unpardonable omission should we neglect to commend this wise action on the part of the interest.

Let the price of skimmed cheese be what it may, and without regard to the success attained by the few who have adhered to the practice of skimming, we would say, let us as a section cleave to the course marked out the past season, and endeavor to advance and improve the quality of our product still more, if such a thing is possible, and thereby give permanency and stability to the interest. The adoption of any other plan we believe to be suicidal to our best interests. In this connection, and bearing upon the establishment of a reputation, we would urge upon dairymen the advisibility of a proper representation at Philadelphia during the Centennial. Many facto-

ries have signified their intention of aiding in such a representation. The committee having this matter in charge have already received thirty-four boxes of cheese for that purpose. Forty-one more are needed to guarantee a respectable display, and we trust this convention will not adjourn without making some provision for the amount still required.

Finally, we have now discussed at some length what we believe to be the present requirements of the business. No one can more fully appreciate than myself the difficulties of the task, resulting, in part, from my very inadequate knowledge of the business, but if you can sift a little good from the chaff, I shall, on my part be satisfied that the effort has not been altogether in vain.

It remains for us now to review briefly the future of the dairy interest. The thoughts which will no doubt be suggested, are these: Has there been an over production the past season, and what is the prospect for the coming year? We are inclined to think that there has not been, properly speaking, an over production, but rather an under consumption, resulting from the hundreds of thousands of laborers, both in this country and Europe, who are now out of employment and without the usual means of livelihood. It is unnecessary at this time to discuss the cause of the utter stagnation which now rests upon every branch of business and of commerce. We know it exists, and God only knows when it will cease to exist, is the reply of the statesman, as well as the peasant. We believe there is much cause for encouragement to dairymen for the coming year. Owing to the low prices which have ruled in various sections during the past season, many will forsake the business and those who remain steadfast will increase their stock but a small percentage. As to any improvement in prices it will be useless to venture an opinion; but we believe, however, taking everything into consideration, it will prove a more satisfactory year to dairymen than the past has been.

In closing, allow me to urge upon the factorymen more united action, and the cultivation of that generous spirit of rivalry which makes even defeat seem as a victory, and to the five thousand patrons whom we serve, the importance of a more thorough study into the details of the dairy business, thereby enabling us, as a dairy section, to attain still greater success in the years to come.

SELECTION AND BREEDING OF DAIRY CATTLE.

BY C. E. BALDWIN, NELSON, O.

MR. PRESIDENT AND GENTLEMEN :—Western Pennsylvania has its rivers of oil, and there is much to convince a stranger that it is a land flowing with milk, if not with honey. I was not aware until recently that dairy husbandry, and the manufacture of dairy products in your State, had attained such magnitude in their operations. But, gentlemen, without further preliminary remarks, we will proceed to the consideration of the subject which we are to discuss at this time. I refer to the "selection and breeding of dairy cattle." First, as to the importance of this subject. It is evident that no other subject connected with the dairy interest demands your careful attention to such an extent as this, for the reason that the application and practice of correct principles concerning this subject will effect an improvement not heretofore supposed possible; also, that it has not been considered sufficiently heretofore by associations of this kind, and comparatively little understood among practical dairymen and cattle-breeders. Even the "cultivation of the grass" is not as important, so long as such quantities of hay and grass are consumed by animals that are unprofitable for any purpose. It is reasonable to suppose that whatever progress will be made in the improvement of dairy cattle, as with other questions connected with the dairy interest, will be made chiefly through the instrumentality of Dairymen's Associations. It is apparent that dairy cattle have not attained that high distinction for their particular uses, which generally characterizes other domestic animals. To illustrate: The well-bred pointer pup, at six months of age, without training, will stand staunchly on a bird, thereby showing the skill of man in breeding for a specific purpose. The well-bred shepherd dog, greyhound, foxhound, terrier, mastiff and those of various other breeds, each uniformly shows the inheritance of its peculiar characteristics. Great differences exist in the various breeds of horses, showing in the same manner the great success resulting from a correct system of breeding. Sheep and swine are also successfully bred to meet the different requirements of the markets. In the "breeding of poultry" it is astonishing what has been accomplished in producing such exact similarity in the different individuals of the same breed. We have also several breeds of cattle which, considered as animals for the butcher, have great adaptation for that purpose. Among dairies of the common cattle of

the country, and where fed, and cared for alike, the production of milk in quantity and quality, of different cows, is very far from uniform.

Even among the Ayrshire and Jersey cows, breeds to which much attention has been given to make them superior for the dairy, there are many only moderately good, and some that are comparatively worthless, while those which are extraordinary, are not very numerous. The most that can be said of these breeds, is that their *average* excellence is greater than in other breeds. But thorough-bred cattle of the dairy breeds are yet too scarce and valuable, to be introduced generally among dairymen, *and are not more profitable than such as may be bred from a portion of the common stock of our country.*

There are cattle in considerable numbers in almost every neighborhood whose worth as breeders is not appreciated. If such were intelligently selected and bred together, they would reproduce in their progeny their own superior qualities, with scarcely an exceptional failure. These cattle, although unlike in size, color and other appearances, and many of them of little value as "butcher's beasts," are in reality, so far as their fitness for the dairy is concerned, *thoroughbred cattle*, for the reason that the peculiar characteristics which indicate the value of cattle for the dairy, are alike, no matter of what breed or of what difference in general appearance. Compare the English race horse and the greyhound, although they are of different species, and quite unlike; if points which indicate fleetness, only be considered, they will be found to be identical. To breed superior dairy cattle, therefore, we have only to select and breed together, regardless of race, such cattle as have the peculiar characteristics hereafter described, which are nearly the same in both sexes, except that in the male, they are modified and partially hidden by his masculine appearance. Many farmers practice with considerable success, raising heifer calves for the future dairy, from their best cows for milk, regardless of other considerations. Now, we have only to carry this principle of "selection and breeding" further, to attain complete success, *i. e.*, to select cows that not only give a large quantity of milk of good quality, but also such as possess those peculiarities which are indicative of their reliability to reproduce in their offspring their own good qualities. Great care should also be taken in selecting the bull or bull calf, that he possess all the qualities necessary to constitute him a reliable sire. It is less difficult to breed bovine excellencies for the dairy, than for the shambles. With a proper regard for correct principles in breeding, dairymen may have all their cows "best cows," as soon as sufficient time has elapsed to raise them.

If the method of judging dairy cattle at agriculture fairs and at public sales, be taken as a criterion by which to estimate the extent of knowledge upon this subject among farmers and cattle breeders, it is safe to reassert

that the "selection and breeding of dairy cattle" is but little understood; for, with few exceptions, judges, or buyers pay but little regard, if any, to the "escutcheon" or "milk mirror," lacteal veins, veins of the udder, perinium, thighs, or the spinous processes of the vertebra, or even place their hands upon the animal to ascertain the quality of the hair, skin and flesh, all of which must be carefully considered, in order to make anything like accurate estimates. Symmetry, and other points of beauty are too often taken as the only standard. In my State, (Ohio,) an Ayrshire cow of fine symmetry and great beauty, but otherwise the most unworthy animal in the herd to which she belonged, has taken a great number of premiums at many different fairs, (including the State and Northern Ohio fairs,) competing with others greatly excelling her in yield of milk. A bull calf from this cow was also considered very noteworthy, and in calfhood, and as a mature animal, was awarded large premiums in competition with much better animals of the same breed, and finally proved himself to be quite worthless as a sire of dairy stock, although like his dam, having a choice pedigree. Such errors are disgusting to the exhibitor and detrimental to the public good; and could never occur under a proper system of discrimination. Great numbers of errors of this kind occur annually at our fairs. While the greater part of what I have to say on this subject is knowledge that has been extant for many years, some very important facts I have myself discovered, that in connection, complete a system, which, as such, is *new*, and has not to my knowledge, been observed in breeding dairy cattle by any one except myself. By observance of these principles I have succeeded beyond any expectations entertained previous to giving it a fair trial, extending through several years. A thorough understanding of this system of points or qualities will enable one to estimate with a great degree of accuracy, how many pounds of milk a cow will yeild daily, feed, care, and condition being considered; also its quality, and how well she will continue to yield later in the season, or as maternity approaches. Heifers and heifer calves, can also be judged by this system, but not with the same degree of accuracy. The value of a bull as a sire of dairy stock may be determined with precision, while that of a bull calf may be estimated nearly as well.

I will now attempt to describe this system. It consists of a great number of points and qualities, which may be divided into two classes. The first class consists of such as are not *certainly* indicative of superiority, unless the animal possesses a large number of them. The second class consists of three points or qualities which are of the greatest value, for they will indicate truly the natural capacity of cows for the production of milk, if in good thrift, and free from disease or injuries. The query may here arise, why other points are regarded if these three are infallible? I will

simply say that cows which possess these infallible marks, and of course yield a large quantity of milk, may lack largely in points mentioned in class first. In this case they may or may not reproduce their good qualities in their progeny, even though associated with a well marked bull. But cows possessing in a high degree all the points in class second, and many or all of those of class first, will, if associated with a bull of equally good points, reproduce their good qualities in their offspring, almost without exception. I will now attempt to describe the points or qualities referred to, and will endeavor to include every point which is indicative, even in a slight degree, of the value of cattle for the dairy. Superior dairy cattle are generally of medium or small size, and as a rule, are of blended or mixed colors, and nearly without exception with a sprightly, nervous, or restless disposition, though exceedingly kind and tractable if properly handled; and, if properly reared, and in the absence of disease or injury, will possess strong constitutions and great vigor. The contour should be as follows: The *head* should be small and cleanly cut, and being principally of bone, if small, indicates fine bones throughout the frame. With few exceptions, it is only fine-boned cattle that are prime for the dairy, however rough or ill shaped they may be. The head should be rather long from the eyes downward; *mouth* large, with thick, strong lips protruding at the sides, which give the muzzle a flattened appearance; *eyes* full, protruding and showing considerable white at the inner corners; *eyebrows* not too coarse or ridged, or deeply cut with wrinkles; *face* very dishing between and above the eyes, and in a line from the muzzle to a point midway between the base of the horns should be concave; *horns* set upon a rather high pate and have an upward and forward direction at the base; should be tapering and not deeply cut with annual rings. As a rule, the annual rings upon extra cows are rather indistinct and blended together. The *neck* should be thin but not too slender, nearly free from dewlap, and neatly joined to the head and shoulders. The *brisket* should be rather thin, and of neat appearance, and well down and forward. The *shoulders* should be thin, small, and of neat appearance at the top, but with good breadth at the shoulder points, and also considerable lower than the hips, making, particularly in the female, a light shouldered animal. That portion of the body between the shoulders and hips should be short, ribs rather straight, making the animal low-sided. The *abdomen* should be large with the intestines well down, giving the animal a "baggy" or "sagged" appearance. The space between the hock-bones and ribs, large; *flanks* light, and much space between the thighs at the twist; *udder* large and flexible, and covered well with soft fine hair; *tail* rather long, large where it joins the body, but tapering well to the brush; *legs* short, hind legs rather crooked. Superior dairy cattle are more thirsty, ruminate more, and have greater powers of diges-

tion than those that are inferior in milking qualities. The quality in hair and handling consists of a mossy, downy feeling, not only of the hair and skin, but of the flesh underlying, which should yield easily to the pressure of the fingers upon the sides and other parts of the body, and exists in perfection only with those animals which have the best quality of flesh. These constitute the points and qualities of class first, except a few to be hereafter explained from the illustrations. The points referred to in class second are three in number, viz: the peculiarities of the spinous processes, both vertical and lateral; the veinous system that has special connection with the milk secreting organs; and the escutcheon or milk mirror, this being the most important mark to consider. The lacteal veins are of five different kinds, and the escutcheon of three, each kind being a combination of three parts, viz: the vertical, thigh, and front mirror.

The peculiarities of the spinous processes have also three distinct differences.

The chine is that portion of the back just back of the shoulder, and is either single or double. How can this bone indicate milking qualities? The quality of the bone is modified by the degree of domesticity in all animals, and there is no other animal on the farm so far removed from the natural state as the cow, and the bones of the first class cow corroborate what I have just stated, when compared with those of inferior quality, the former being softer and much fuller at certain points, especially at the chine.

The perfect milk vein is not only large, but, as it were, knotted or crooked in its course.

The orifice through which the vein passes into the body should be large, and both sides *alike* large.

The larger the veins covering the under and inside of the thigh the better.

The most important of all the marks of the milch cow is the milk mirror or escutcheon.

This may indicate to us, if closely scrutinized, very clearly the actual character of the cow, and not only the cow, but also of the male, and even of young cattle of either sex. In judging cattle by the mirror, however, we must consider the size and appearance of both front and rear mirror. The latter may be large and the front may be small, but, so far as I have observed, if the front mirror be large the back mirror will correspond, and the cow be a good milker, with a well formed udder.

And yet the mirror may be full and the cow be of little value, because she may be blemished and dry up so early as to render her nearly worthless.

The quality of milk of different cows may be known with much accuracy, by a critical examination of the "secretions of the skin," or dandruff from the different parts of the body, but particularly that of the escutcheon. In white, or light colored cattle, these secretions will be more oily, and of

a richer shade of yellow, or yellowish brown, than in darker colored cattle, whose quality may be equally good. The dandruff of the escutcheon, forehead, end of the tail and other parts of the body, as well as the sections found in the inside of the ear, should be carefully examined, and that which is most oily and of highest color, the color of the cattle being considered, will indicate those animals yielding the best milk for making butter. This test cannot be used just before the time of calving, and after the udder becomes swollen, as the parts most important to examine, seem to be in an absorbant condition, and little or no secretion takes place. The application of this test will also indicate the comparative value of the bull as a sire of "butter stock." There is, however, a class of cows, many of which will yield a large quantity of milk of good quality for a time after calving, and until coupled with the bull, and conception takes place, when they will go dry, or suddenly fail of a portion of their milk, in from fifteen to twenty-five days after conception, at which time the quality of the milk becomes poor, and sometimes so changed as to hardly have the appearance of milk, but resembling more the "mucus secretions." These cows I denominate *bogus cows*, and a number of them in a dairy will materially injure the quality of its products. Cows of this character are very vigorous, and will rarely fail to breed upon the first association with the male.

To the superficial observer they appear to be much more valuable than they are, from the fact that they show many of the more prominent and well known marks of good milkers, and are in fact, good milkers, but only for a brief season.

The deception exists in the tendency to fail of their yield, both in quantity and quality, prematurely.

The marks indicating this tendency are well nigh infallible, and by their observance, such cows may almost certainly be detected.

These bogus cows are usually valuable only as breeders of fine steers or beef cattle, and have no place in the dairy.

[At this point Mr. B. proceeded to illustrate in detail all the points referred to, by means of several large crayon drawings of cattle, taken from life, some being of the very best cows, and others the reverse, and by comparison of points, established the correctness of his theory.

He also exhibited several bones and portions of skin with the natural hair on, showing the various forms of the milk mirror and the points of difference between the true and the bogus dairy cow.

He stated that this system of marks is observable in the male, and transmissible to his progeny.

His explanation of the points of the milk mirror differed somewhat from those laid down in the books which treat on that subject.

The address embraced much that has never appeared in print, the results of close observations for a considerable period of time, of one well qualified to draw conclusions from facts.

It is to be regretted that Mr. B. has not been able to obtain cuts to accompany his address, and thus render it more easily understood by the reader.—SEC.]

GRASS.

BY COL. O. O. POTTER, OF POTTER'S CORNERS, CRAWFORD COUNTY, PA.

MR. PRESIDENT AND GENTLEMEN:—I am happy that I have cause to congratulate you and the dairymen of the whole country, in these closing days of the year, in having realized a bountiful and profitable season. And especially have we of this region abundant cause for devout congratulation and thankfulness in having been spared the visitation of drouth which scourged extensive sections of the country during the summer. Our vegetation has been bountiful and luxuriant, the product of our dairies has swollen to an enormous figure. An auspicous omen for the future of our agricultural prosperity, and although prices have ruled lower during this season than the average of former years, yet what product of the farm, even this season, pays as well or renders as quick returns as that of the dairy. Rejoice, farmers of North-Western Pennsylvania, that the dairy has become the leading industry and a permanent feature of our agriculture. But the grumblers ye have always with you. So there must always be grumblers amongst the dairymen. Some perhaps with reason, others with no reason at all. The probability is that the loudest grumblers of all have received more money through their factory during the season that they have been accustomed to receive from all the products of their farm together under the old hit and miss system in vogue before the era of the factory system.

Of all classes of business men the farmer is most neglectful in his book keeping, for the most part we carry the figures in our heads, and are apt to guess at things instead of trusting affairs to demonstration by the rules of addition and subtraction. From this shiftlessness arises in a great degree the habit of grumbling over what we really know but little about, to wit: The history in exact detail of our financial affairs. The kind of carelessness and neglect, in these particulars, which would be considered criminal in any other business is the rule with the farmer.

A closer attention to accounts, a complete system of debit and credit with the farm itself as well as with our neighbors. A strict account of profit and loss, in which the laconic history of our own neglect, wastefulness and want of care, are chronicled in serried columns of remorseless figures, would foot up a powerful aggregate against us annually, teaching us what kind of farming pays the best and where the profits go to, shutting the mouth of the grumblers and proving those nine digits, very apostles of reform to farmers.

What percentage of farmers make their business the earnest study of their lives? Are they not few and far between? And yet that is the secret of success in any business.

The successful lawyer, merchant, and manufacturer brings brains into his business, and the farmer has no less need of brains in his business than they, and yet there always has been, and doubtless always will be, a large class of farmers who do not make their business their study.

These are they who loftily despise what they term book farming and discard as unworthy of their attention all printed suggestions relative to their business, although, happily, the ranks of this army of wise men are continually and rapidly being depleted by desertion. The widespread and rapidly increasing volume of agricultural literature is exerting a most beneficent influence, its salutary effects are becoming more and more apparent in the formation of associations like this, in farmer's clubs throughout the land, in arousing thought amongst the masses, in awakening discussion upon the various questions of the day and in arousing a general interest in all matters appertaining to agriculture.

One of the leading questions for the farmer to decide is, what of all the products of the farm can be made most profitable under the surrounding circumstances, and in forming a conclusion it is altogether necessary, situated as we are midway between the markets of the east and the grain growing empires of the west, that we ask ourselves what we are to do to be saved from the over shadowing competition to which the colossal productions of the boundless prairies have given rise?

Solomon says, "The wise man forseeth the evil and hideth himself, the fool passeth on and is punished." Manifestly, if we would be wise we must concede that competition with the west in any of its cereal productions is simply a hopeless and fool hardy effort, and as a consequence beef and pork must be included.

These products the western farmer is able to produce at a cost merely nominal, as compared with the cost of producing them here.

The expense of transportation from the Mississippi to the sea board market is even less than the cost of carriage hire from here to the same markets.

How hopeless then the effort to compete with that vast granary of the world in the general markets.

Do not understand me as recommending that we raise no grain, fatten no beef or pork, but only that we refrain from attempting either of these as a chief production.

The thrifty farmer will raise grain, fatten beef and pork for his own consumption but ought to produce no great surplus of either.

"Then," I hear it asked, "with no surplus grain, beef, or pork, what shall we produce?"

In a word, and this brings me to my subject, I answer, *grass*, the natural and foreoredained product of our soil. Ours is not and was never intended to be a grain producing section, it is and was designed to be a grass producing region.

It is an ancient apothegm that "the mill of the gods grinds slowly, but it grinds exceedingly fine."

A beautiful illustration of the slow but steady and noiseless results of nature's laws. She is a kind and indulgent mother if we but heed her teachings, but stern and inflexible if her behests are disregarded.

It is a tedious and toilsome labor to row your boat against the swift current of the stream, but turn her bow, let her glide with the current and she dances like a thing of life swiftly and easily to her destination.

The farmer is brought most intimately and closely into contact with nature, his life labors are within her great laboratory and the result of his labors, whether crowned with success or terminating in disappointment depends upon the fact whether he acts in concert or conflict with her laws; if the former he glides with the stream to an easy success, if the latter he must bring muscle of iron and nerve of steel to the work, of paddling his canoe, and even then nature will beat him in the long run.

The mill that grinds so slowly and so fine will grind the results of his labors into impalpable powder.

The statement that ours is a grass producing and not a grain producing region will be so generally conceded that any argument upon that subject would be superfluous.

If, then, the Creator has so ordered it, would it not be wisdom for us to lend our energies to the work of aiding nature in her laudable designs, instead of blindly attempting to counteract them or listlessly permitting her to do all the work.

In other words, my aim to-day is to urge the *cultivation* of grass. Meadows and pastures we have in abundance, but how many farmers make the proper preparation of the soil, the kind and quantity of seed, the nature and character of the various grasses, and the care and management of their grass land anything like a study?

For wheat, corn and crops of other kind the soil is prepared with more or less care and commendable pride is usually taken in their subsequent care and management.

When a field is to be seeded to grass it is usually by the rule of rotation, after other crops. First a crop of corn, followed by oats, then a crop of wheat. A small quantity of timothy seed is sown after the wheat is harrowed in, and in the spring a small quantity of clover seed is sparingly

sown. After the wheat is harvested more or less stock is turned on for fear the clover will get too large and smother out during the winter. Then, a little pasturing in the spring, and a thorough pasturing from haying until winter is the rule. After the second year the clover is, of course, missing, and the timothy is in a bad way—plantain, dandelion, dock, daisy and the whole family of tramps find their way into the roomy, blank spaces; the mowing machine rattles over the field, the horse rake scrapes together the half ton of indifferent hay, and the history of that meadow is written. The barn yard is emptied upon it the next spring, and a similar rotation is commenced with similar results. Is not this a somewhat true account of a majority of meadows?

Of what manner of fields also are our pastures? Are they not the ghostly ruins of such meadows as I have described? The clover and timothy gone, save here and there a straggling spear of the latter, and in their place a sparse growth of natural grass, red top, June grass and the like are having a lively contest with the wild grass, and those wandering Arabs of our fields just mentioned. Or let us look at another lovely rural picture, an old, half-cleared hillside, or a marshy and broken field, bordering some sluggish stream, largely occupied by decaying logs and stumps, bearing a liberal growth of brush, briars and brambles, noxious weeds, swamp grass and all manner of vile herbage that when cropped by the hungry herd is more likely to lend pungency than an odor of sweetness to the milk, deteriorating the quantity as well as the quality, of the product.

Many of the natural grasses of these wild upland pastures are sweet, vigorous and hardy, springing spontaneously from the virgin soil. They fight long and sturdily to hold their own against the many ills that grass is heir to, but gradually they become enfeebled by close grazing, over-stocking, drouth, worms and grubs until moss and wild vines assert their mastery, and the poor grass succumbs under an accumulation of discouragements, and finally disappears, and to add a still darker shade to this dark picture, the probability is that the water-pool is trodden into mire and nastiness, and from this the herd is compelled to quench its thirst throughout the long days of summer's fiery heat.

Possibly the cheesemaker, if he is wide-awake and thoroughly acquainted with his business, complains that there is something wrong with the milk. Whereupon there is a commotion in the household. The housewife is worried; the "good man" frets, is sure the superintendent is a blockhead or worse; is dissatisfied with the scanty product of his herd; all hands are puzzled and out of sorts, and he resolves to sell his cows and quit the business.

This is by no means a fancy picture. I ask is not this modified by circumstances the character of a large percentage of the pastures throughout

the vast region from which this intelligent assemblage of farmers are gathered?

And yet there are many farmers of good repute who confidently believe and assert that these old rubbish pastures produce more and better feed than any other. I suggest that a ready test of the question might be made by permitting one of these old fields to remain unpastured until mid-summer, and then if the state and character of its vegetation is such as will warrant the statement I shall be most happy to concede that the old bush pasture is the very best thing.

The circumstance of the hour forbid further argument upon this point, and I will only add that I as confidently believe and assert that until a radical reformation takes place in the general character of our pastures the gilt edge standard can never be reached in the product of our dairies.

All the profits of the dairyman depend upon the quantity and quality of the product of his herd, so quantity and quality depend largely upon the abundance and character of his pastures. Without gilt-edged pastures, we must look in vain for the highest golden, or even greenback results.

The question then forces itself upon us: How is the reformation in the matter of pastures to begin, and how is it to be wrought out to a successful result? I answer, by subjugation—introduce civilization in place of savagery through the influence of fire and the plowshare. Reduce these old fields to meadows, where the mowing machine's swift shuttle shall flash through the grass of two tons of hay to the acre, without meeting with other obstruction; and when the sward has toughened and grown hoof-strong, remand it to pasture. And here we meet the great difficulty face to face. The universal complaint is that pastures and meadows are never permanent except it may be upon rich, alluvial bottoms or upon virgin soil. When the land is first cleared the soil holds within itself the garnered fertility of the ages—the very nursery of the grasses, whether natural or cultivated; whether the seed be sown, or whether it be left to its own wild will, the result is generally a grass field of wonderful permanency and production.

The lesson which nature teaches in this is plain and simple, and if we fail to heed it, we row against the current—the mill grinds on.

If we would have permanent pastures and meadows of remunerative productiveness, we must give our grass fair play, as well as other crops. Prepare the soil of old fields for this as well and carefully as for corn, and before seeding down, as it is called, be sure that the field is in such a state of fertility as to be capable of producing a good crop of corn. Grass of one kind or another will grow upon almost any land, but the sweetest grasses, and in large crops, can only be obtained from rich and unworn or good and thoroughly cultivated old soils.

It is often the case that the farmer possessing a tract of this half-civilized bush pasturage finds it impracticable to commence a systematic fight which shall end in the absolute subjugation of the monster for several years to come—in that case a guerilla warfare is better than no fight at all. Cut the elders, brush, briers and brambles, burn them, harrow thoroughly wherever the harrow will touch enough to tear; sow grass seed, and where the soil is thin scatter fertilizers—wood ashes will do, leached or unleached, lime, plaster, leaf mould from the adjoining forest, or a few loads of barn-yard manure will do no harm; turn on the sheep—continue these little attentions for two or three years and you will be surprised at the improvement.

The next important step is the selection of the seed and the proportioning of each in such quantity as shall best effect the desired result. And here I beg leave to recommend the use of a much greater variety of the grasses than is usually sown. In fact, I know no farmer in this region who sows any of the grasses save timothy and clover. Permit me to disregard the technical to-day and call clover, grass, in defiance of botany. I think there may be many who are ignorant of the fact that there are several varieties of the cultivated grasses that are but slightly inferior to timothy for hay, while the most of them are fibrous rooted, hence much more hardy and nearly as productive.

By your permission I will mention a few, with a brief description of each:

Meadow Foxtail is one of the most valuable pasture grasses; it is early, productive, succulent, nutritious, a favorite with stock generally, especially cattle. It has a luxuriant aftermath, and furnishes a good bite within ten days after being closely cut or cropped. It requires about three years to get itself fully matured and in possession of the soil, but it is hardy and permanent, and flourishes on almost any soil, though best on moist, loamy clay.

Orchard grass is one of the most valuable of all the grasses. It is very early, starting with the red clover, is strong and quick in growth, ripening with the clover, and is, therefore, well suited to it as a companion. It is well adapted to either meadow or pasture, yielding as much hay as timothy, though, perhaps, not quite so valuable. It is relished by all kinds of stock and has no superior for its milk-producing qualities. It is permanent when well rooted, hardly ever running out. It flourishes on all kinds of soils, but best on a sandy or gravelly loam, and grows luxuriantly in the shade—hence its name. It will stand close and continuous cropping, and lasts well into the season of frosts. I have orchard grass, grown under thick shade, that looks as green to-day, (Dec. 31, 1876,) almost, as in the early fall.

June grass—known under various names, as Green Meadow grass, Common spear grass, Blue grass, and notably, Kentucky Blue grass. It is very early, hardy, palatable and nutritious; it is indigenous to our soil and climate; it is the common grass of our roadsides, and as a pasture grass is scarcely excelled. It is said that butter made from this grass will keep sweet longer than that made from any other species. It is permanent, not easily driven out—it defies the winter and resists the drouth more sturdily than many other species. It loves a limestone soil or a loamy sand or gravel. Kentucky, in both soil and climate, seems to be favorable to its perfect development. It is one of our most valuable pasture grasses. Blue or wire grass belongs to the same family or genus as the last mentioned, and bears even a higher reputation for its nutritious qualities. It is very hardy and flourishes on thin and sandy or hard rocky soils. It is permanent and one of the sweetest of our natural pasture grasses, causing an abundant flow of the richest milk. Stock of all kinds feed upon it with avidity and fatten rapidly. It is well adapted to the localities of thin knolls and stony hillsides.

Meadow Fescue is one of the most valuable pasture grasses. Natural to a moist, clay soil, it is early, very nutritious, ripens its seed early, is very permanent, has fibrous roots, is therefore hardy, but slow in arriving at full maturity.

Rough Stalked Meadow grass is adapted to moist clay soils, not so nutritious as some others, but a fibrous rooted permanent grass, much relished by stock and very productive. It is adapted only to moist soils.

Red Top is a familiar friend, an excellent pasture grass, bearing close cropping, likes a moist soil, but grows any where, and mixed with other grasses, largely assists in making a first rate pasture.

White Top, or white bent, is cousin to the red top, and is adapted to lands that overflow.

Blue joint is adapted to low lands, is nutritious and relished by stock. Thus I have briefly mentioned a few of the best grasses peculiar to various soils, my time and your patience forbid my extending the catalogue; there are many others of great value. I believe that the rye grass holds about equal prominence in English meadows that Timothy does in our own. In rich pastures of natural grasses, springing spontaneously from the soil, originating no one knows how, a large variety is always to be found. Is not this a hint from the old mother that if we would rival her productions we must not confine ourselves to one or two sorts, but scatter a variety with a generous hand? I will say but a few words with regard to our old friends timothy and clover. I do not advocate the practice of sowing them together. The common clover ripens and dies, or, at least, it is far past its prime, before the timothy is fit for cutting. Clover and orchard

grass, as I have suggested, go well together when but two kinds are to be sown. In any case be not sparing of the seed, six quarts of clover seed and ten pounds of orchard grass is recommended, and early spring the best time.

In sowing timothy by itself, as is a common practice, a peck or fifteen pounds of seed is not too much, as with a liberal quantity of seed the grass takes immediate possession of all the space, repaying you by a greater yield of hay the first season, keeping out the weeds, and, if it is too thick the second year, the Darwinian theory of natural selection will correct the trouble.

The following mixture for permanent pastures, which may be somewhat varied in different localities, is recommended by Mr. Flint for permanent pastures: Meadow foxtail, two pounds; orchard grass, six pounds; red clover, four pounds; rye grass, four pounds; timothy, four pounds; June (Kentucky Blue) grass, four pounds; meadow fescue, four pounds; red top, four pounds, and rough stalked meadow grass, four pounds. If the above is to be reduced at all leave out the clover.

My private opinion is that I should leave out the white clover under any and all circumstances.

Mr. Chas. I. Flint, Secretary of the Massachusetts State Board of Agriculture, compiled numerous tables of mixtures similar to this, adapted to various soils, which may be of great assistance to farmers, and can, of course, be varied indefinitely, but the principle should not be forgotten. Sow such quantity and variety as shall ensure their taking entire possession of the land; otherwise inferior grasses and noxious weeds will fill the vacant spaces.

Plantain, dandelion, dock, thistles, and their motley throng of vagrant companions, are ever on the alert for a foothold in pasture and meadow, and they are seldom at loss for an opportunity. The presence of one signifies a regiment of followers; but if the pioneers find the land occupied and possessed by the useful member of the agricultural family they will seek elsewhere a camping ground for their gipsy gang.

It is our custom, at the opening of spring, to empty the winter accumulation of our barnyards upon our prospective corn crop, together with a large percentage of both our summer and our autumn labor, while never a fertilizer, except the droppings of grazing stock, ever finds its way to pasture or meadow, on the contrary the pasture is cropped from spring to winter as close as cattle, horses and sheep can gnaw it, and as soon as the hay is stored the same system of robbing and ruin is commenced upon the meadows.

Is it surprising that our pastures and meadows run out under such treatment as this? I repeat, "The mill of the gods grinds slowly, but it grinds exceedingly fine.

Let us begin a general reform in our treatment of grass; let us recognize it, as it is, the great crop of the country.

Not corn or cotton, but grass is King! According to the statistics of the ninth census, the hay crop of the United States, in 1870, aggregated 27,316,048 tons, with a value of more than $300,000,000.

Let us begin to *cultivate* grass! We have heretofore given it a grudging permission to grow. Let us begin to study and observe the nature and characteristics of the multitude of valuable grasses which are indigenous to our soil, and of which we are almost totally ignorant, and thereby explore a mine of wealth heretofore unheeded, which the God of nature has placed beneath our feet.

There is no crop that shows such deep rooted gratitude for kindness received at the farmer's hand, and returns the compliment so promptly and munificently as grass. Let us begin the experiment of giving a portion of our fertilizers to our meadows and pastures, even if we are compelled to make our corn fields smaller. Let us begin to be satisfied with our meadows if they do yield us only one crop during the season, the aftermath pays a large interest if simply let alone. I trust the day is not far distant when the practice of pasturing meadows will be numbered amongst the barbarisms of the past. And, now, while touching upon fertilizers for grass land; while I know that not one in a hundred feel as though they can spare a load from the barnyard for top dressing those thin spots in the meadow, even at the risk of being charged with desire to advertise Mr. Whiting's wares; let me tell you that nature, by the hand of mystery, has placed within the heart of Crawford county, and within the reach of many of you, one of the cheapest and most efficient of all the mineral manures. I mean the so called Harmonsburg marl. I am not aware of its constituent parts analytically, indeed I am not aware that any specimen has ever been submitted to scientific analysis, yet fire shows a very large percentage of what may be termed shell lime—the best lime for agricultural purposes known. The residue consists of peat ashes and I know not what besides, harmless without a doubt, if not valuable. At all events there it is, lime in abundance, and cheap almost as dirt, and yet who uses Harmonsburg marl in any quantities? Some future generation, near or remote, will learn to appreciate it as a rich mine of agricultural wealth.

Let us read up on lime, and when convinced that it will pay, let us take the goods the gods provide us, and by such means as lie in our power, nourish and protect the grass, thereby developing permanent pastures and meadows, and when once our fields are subjugated and brought to such culture as warrants in seeding them to grass, we may leave the plow to rest somewhat from its labors and learn that the farmer may thus rest from much hard labor; learn that to live by grass, brings lighter toil and greater profits than to live by grain, besides our pastures and meadows increase

constantly in fertility, while the greatest skill, labor and expense is required in grain raising to prevent the utter exhaustion of the soil. For instance, a piece of ground in proper tilth is seeded down to meadow, and no ground is in proper tilth which will not, under favorable circumstances, yield two tons of hay to the acre, give it fair play, no pasturing and the aftermath left on interest; your grass crop will increase its product each year, and after a series of crops, say five or six, aggregating from ten to fifteen tons to each acre, plow it and plant to corn, using no manure or other fertilizer, would you have any doubt of getting a good crop? No farmer of experience would have any doubt at all, but reverse the process, continue it in corn or other grain for a like period of time without fertilizers, and what then would probably be the condition of its fertility? I need not answer the question, the veriest tyro in farming knows that such a course would be ruinous. This is a test with which we are all familiar, can anything be more simple, more convincing?

Gentlemen, I feel that I am advocating a self-evident proposition when I repeat that in regions designed by nature for the production of grass, the leading feature of husbandry should be its cultivation and utilization, and the latter term involves the question, What shall we do with it?

Three channels invite our enterprise, the dairy, stock raising and the production of hay for market. Personal taste and surrounding circumstances will govern in a great degree our choice, or the three may be combined. In this region the dairy stands pre-eminent over all. Crawford county alone with her sixty cheese factories, and their product of 6,000,000 pounds the past season, together with the private dairies, must have returned into the pockets of her farmers somewhat more than one million dollars and still the business is but just getting fairly established. That the business is a permanent success is evident from various signs of the times. First—It brings the most money to the farmer—brings it more promptly, certainly and easily than any other branch of the occupation. Secondly—The business has been brought to a more perfect system of co-operation than any of the others, and because it is a success, it is possible to gather together such an assemblage as we see before us, Mr. President, of the leading farmers of this and adjoining States—wide-awake farmers, who, realizing that the world moves, come up here to meet and work with their brethren, to interchange ideas and, speaking nautically, "take an observation," to see how far we have got.

Another conclusive proof of the permanent success of our dairy interests is manifest in the generous warmth with which we are welcomed by its business and capital to your beautiful city. We, the gentlemen of the barnyard, carrying hay seed in our hair, welcomed by its wealth and commerce to a city!! This speaks volumes; for with business and capital, you know, success is virtue, failure is a crime.

EXCLUSIVE MEAL FEEDING.

BY LINUS W. MILLER, STOCKTON, N. Y.

MR. PRESIDENT AND GENTLEMEN :—One year ago I had the honor of addressyou upon the subject of exclusive meal feeding, as I practice it. The fact that you have invited me the second time to continue its discussion is proof of your appreciation of its importance, and that the determined ridicule which has assailed my theory on every hand, has not prejudiced your minds against it. For this I tender you my grateful acknowledgements. You will find your reward in its practical adoption. That it is to be adopted when understood I cannot doubt.

As dairymen seeking the best methods of feeding for profit, I invite your consideration of such facts as my own limited experience and that of others who have tried my system afford. Inasmuch as it involves a suspension of rumination hitherto considered indispensable, its effects upon the animals thus fed, their milk product, health, length of life, tendency to fatten and the character and quality of their offspring generally, are matters of the gravest importance, which call for the closest scrutiny.

The value and weight of my observations you must determine for yourselves. It will take many years of continued meal feeding to satisfactorily settle all the questions involved in the innovation, but to minds free from prejudice the facts already established are of the nature of demonstrations. Let us examine the facts. For six different seasons during the last twenty years, I have fed meal exclusively to my dairy herd for a greater or less length of time.

The four first seasons were detached, the two last consecutive. During the first my milk was manufactured into butter at home, and that was not weighed, but I had occasion to contrast during these years the yield in milk after meal feeding with that after ordinary wintering upon hay, and invariably noticed a perceptible difference in favor of meal feeding, a difference so marked as to render mistake upon the point impossible.

There is a bare possibility that the increase in these cases was accidental, and that the product would have been the same if the previous wintering had been upon hay.

There is always more or less uncertainty in tracing results to their true cause in the matter of milk product in consequence of abundance or scarcity of pasturage.

We can easily regulate and estimate the amount of winter feed, although there may be a great difference in the nutritive value of hay in different seasons, pound for pound, from various causes, but we cannot grade our pasturage or control the season so as to produce uniformity of growth. In comparing the yield of my cows during these periods this uncertainty is entitled to consideration.

Whatever the cause may have been, the fact that my cows always did best after wintering upon meal is indisputable. The calves dropped after meal feeding were larger, stronger and in better flesh than after hay feeding. I submit that this result cannot reasonably be supposed to have been accidental.

Some of these calves I raised, and they are among my best milkers. Whether wintering the mothers on meal had any perceptible influence in developing milking qualities in the offspring, I am not yet prepared to affirm as established.

Another fact early attracted my attention in the practice of meal feeding, viz: All animals wintered in this way, take on flesh when turned out to grass in the spring more readily than when hay fed.

Again, for the three past seasons I have sent my milk to the Stockton cheese factory for a period of about five months each season where it has been daily weighed.

In 1873 they were wintered upon hay, in 1874 and 1875 upon meal. They averaged for the first season a little more than 16 pounds of milk daily, and this was about their usual yield when wintered on hay; for the second season about 20 pounds, and this year, which is my first of consecutive meal feeding, over 27 pounds daily.

During the spring months before turning to grass, their rations being what hay they would eat and two quarts of meal daily; their daily average when wintered upon hay has ranged from 12 to 14 ounces.

The present season upon the same daily rations, they have averaged during this period, 1½ pounds of butter daily—a gain of 75 to one hundred per cent. Their whole product for the season is equivalent to 250 pounds of butter per cow.

Their feed has been the grass of the pasture only. The season was wet and cold; the pasture may have been better than in 1873, but other herds, the milk of which has been sent to the same factory, have shown no corresponding increase of yield. The legitimate inference to be drawn, is that the difference is owing to their manner of winter feeding.

Again, three of my cows proved to be barren last spring, two of which were meal fed with the rest of my herd, but the other was fed what hay she would eat and two quarts of meal daily, and milked for family use till the 10th of March when she was dried off.

The two meal fed cows were milked till the 10th of January, and had about fifty pounds of meal each, during the spring months. They were turned to grass with my milch cows, and in three weeks time were beef and sold as such. The one not meal fed had the same fare, ran dry all summer in the pasture and had to be stall fed in October and part of November, and even then was not in as good condition as those that sold for beef early in June.

Whether this remarkable increase of milk production in my herd, and this quick fattening for beef, have any connection with my manner of wintering, you, gentlemen, can judge as well as I. It is possible that the same results might have followed if meal feeding had not been practiced.

It is an axiom with dairymen, that cows well wintered yield larger returns in milk, than if insufficiently fed, and that if allowed to become poor or thin in flesh before dropping their calves, the latter will be inferior, and the milk product for the following season materially lessened.

Cases of retention of placenta have very rarely occurred after a winter of exclusive meal feeding.

Mr. Philip Larell, the well known butter buyer of Stockton, has wintered his one cow upon an exclusive meal diet, as many seasons as I have my herd, he however scalding the meal, and has twice fed in this way from November till grass grew in the spring, with satisfactory results.

In the spring of 1860, Mr. Thomas Lyne, a tenant of Mr. Truman Todd, of Stockton, who is widely known as a cattle broker, being out of hay fed meal from March 1st till grass grew—three quarts daily to those not in milk, five quarts daily to the milkers, with this innovation upon my practice, that he allowed his cows to range his fields when the weather was favorable instead of keeping them closely in the stables. His herd made more butter that season than they had ever done before.

Mr. Todd informs me that being satisfied of the desirability of meal feeding, he had since then repeatedly urged upon his tenants a renewal of the practice, but they were unwilling on account of the popular prejudice against the smallness of the ration, and the suspension of rumination.

Since the public agitation of this subject, so strong has been the prejudice against it that but few have had the temerity or the independence to test the merits of the practice. All the cases reported to me, however, have been witnesses in its favor.

Mr. Wm. H. Whitney, of Bladensburg, Iowa, writes me that he fed four two-year-olds last winter, according to my rule, which fattened very quickly in the spring when turned to grass. He appends this remarkable statement that during a residence of eight years in that great corn-growing State, he has never heard of another instance of fattening cattle upon meal.

Wm. Beadle, Esq., of Cadiz, Ohio, in a letter to the New York *Times*, gives his experience in wintering two of his herd of cows, feeding under my rules for ten weeks, and strongly endorsing the practice as a great improvement.

In a recent letter received by me, he says: "These cows have done full as well if not better than the rest of my herd running in the same pasture, but wintered on hay." He also commends my rules of feeding as laid down in my pamphlet.

John Adams, Esq., of Ingersoll, Ontario, Canada, wintered a large herd of fifty cows according to my system. He writes me that the winter was the coldest ever known in that region, that his stables were very cold, and that in consequence he increased the ration to an average of four quarts daily, that upon this ration they did not scour, that they went through to grass all right, came in all right, and at the close of the milking season, says they have never done better, and that meal feeding was a great saving to him, both of time and money.

You will perceive that this test of my system by Mr. Adams has great value, at least in two respects: 1st, it shows that the meal ration can and should be graded by the wants of the animal. The intense cold demanded a corresponding increased ration of heat producing food, and the needed supply of carbon was readily found in the meal.

Could an equal amount of carbon have been found in any hay ration that the cows could possibly have eaten if the labor of the animal in its consumption be considerd?

Had the weather been still colder, the animals would have required still more, and it would have been perfectly safe to have fed them accordingly. Ten degrees further south 2 quarts would very likely have met the animals' wants as fully as the 4 quarts, at Ingersoll.

The Greenlander readily consumes his 6 or 8 quarts of whale or seal oil per day, the inhabitant of the Temperate Zone his pound of meat and one or two pounds of farinaceous food with condiments, while he of tropical climes is content with his ration of rice and a few simple fruits.

All animal life is subject to the same laws, and only uniform under the contingency of like conditions.

2d. Mr. Adams has shown that meal feeding can safely be followed in the coldest regions, wherever it is desirable to domesticate the cow or a sheep. The importance of this fact cannot well be over-estimated, and the lesson which it teaches should be heeded.

Gentlemen, I have given you the facts bearing upon my system of meal feeding, as I understand them, in the plainest possible language, without coloring or exaggeration. My firm belief is, that the system tends to develop the milking capacity of cows thus fed, and that all ruminating ani-

mals will fatten quicker and cheaper under this than any other known system. The demonstration of this is within easy reach of any who may elect to test it. Beyond all question, the proofs are conclusive, that three quarts of corn meal, fed in accordance with my rules, is fully the equivolent of twenty pounds of the best hay as ordinarily fed by our dairymen and stock raisers, and that, if necessary, hay may be entirely dispensed with, in wintering dry-stock or sheep with perfect safety.

One bushel of corn ground and tolled will last an ordinary sized cow, of 900 pounds weight, 12 days, and is equal to 240 pounds of hay. Corn at 60 cents per bushel is the equivalent of hay at $5 per ton of 2,000 pounds, and where it can be had at that rate the cost of wintering an animal, weighing 900 pounds, will range from $7 to $10, according to coldness and length of the foddering season.

But hay, as a rule, costs at least $10 per ton, and frequently, in many localities, ranges from $15 to $25. The saving effected, by adopting my system, will be from $5 to $20 per animal, according to the respective prices of corn and hay. In seasons of short and defective hay crops, which are becoming more common, the importance of meal as a substitute for hay is apparent.

As a deficiency of the corn crop seldom, if ever, occurs in connection with that of hay, there can arise no necessity hereafter for sacrificing our animals for want of food.

In these times, when economy in every possible way, with very many, is both a necessity and a duty, meal feeding commends itself to all who are desirous of saving their money.

A new and probably permanent market is opening for American beef in England.

The price of corn in many western States ranges from ten to twenty cents per bushel.

Corn and grass, either separate or combined, produce the richest and cheapest meat, as they do also the best and cheapest butter and cheese.

The poor man, who keeps his one cow, in town, village or country, can winter her safely in spite of $20 or $30 hay.

This may not please those who make a business of selling hay, but they will have to accept the inevitable, and be content with more reasonable profits.

But I am speaking to dairymen who are dependent upon their herds for their living. Your business will become much more profitable if you avail yourselves of the advantages of my system of feeding.

Many will find it very convenient to adopt in consequence of a dispro portion between their meadows and pasture lands.

Meal feeding will enable all of you to increase your herds and keep any portions of your lands under the plow.

In my address before you one year ago, I assumed the direct passage of meal fed to ruminents to the fourth stomach. This has been almost universally conceded in this country for the last fifteen or twenty years.

Our most distinguished agriculturists claimed to have demonstrated the fact contrary to the observations of the French scientists.

During the past season I have slaughtered two meal-fed beeves, and an examination of the stomachs has shown an accumulation of a number of days rations in the rumen. This is conclusive testimony as to the passage of the meal. I found also that, like coarser food, it passed into and through the third stomach.

Feeding meal immediately before the animals were killed, I have also made very careful examinations of all the stomachs of a large number of beeves fattened in the ordinary manner.

The great mass of the meal so fed has also been found in the rumen, with only very slight traces of it in the third and fourth stomachs, where it was probably carried prematurely by the violent death struggles of the animals.

As my rules for feeding are founded not upon theory, but upon practice, I find no good reason for their modification, in this discovery, except perhaps to emphasize the necessity of allowing animals fed under my system all the water they may wish to drink, otherwise if feeding heavily, there might be danger of impaction of the manifolds.

Gentlemen, when this agitation first began, the whole world was arrayed against me. The harmless suspension of rumination and the small ration fed were held to be *prima facia* evidence of the torture of my animals, and their slow starvation.

I was arrainged at the bar of public opinion, accused of either wanton cruelty to dumb beasts, or of falsifying facts. The most ignorant were loudest in their denunciations, but many who assume to be teachers in agriculture encouraged them.

My accusers in many instances, were those who claim to speak in the name of science, as Galileo's claimed to represent the Bible. History repeats itself; the conditions are similar, but I shall sign no recantation from fear of being torn limb from limb.

All reforms and discoveries pass through three stages, viz: Ridicule, discussion and adoption.

There seems to be a lull in the cyclone of ridicule, and for the credit of this generation it is to be hoped the storm is over.

Dissension so far has been in the form of assertions, generally affirming the infallibility of German scientists, whose experiments in feeding, so far as they go, are in no respect antagonistic to my system. Facts will in time

elucidate themselves. The explanation of my system involves a more intricate knowledge of physiological laws than prevails among those who assume to speak in the name of scienee.

Let me be understood. Those who are entitled to the appellation of scientific men have not yet spoken, as I am aware, with the exception of Prof. Johnson, and he treats the subject with all the candor that has ever marked his able writings.

In the future I hope, if my life is spared, to be able to satisfactorily solve some of the problems involved in my system of meal feeding. A thorough investigation of its merits is now in order. When once understood, its universal adoption is inevitable.

MEAL FEEDING.

ROCHESTER, N. Y., *November* 1, 1875.

O. C. Blodgett, Esq., Cor. Sec'y New York Dairymen's Association:

SIR:—Will you, or your society, please take very careful notes of the result and effect of exclusive meal feeding to cows this winter in L. W. Miller's experiments.

Note the appearance and behavior of the animal in every particular, also her appearance and weight at the time of going on to meal as compared to the same at the end of such feeding; to the end that you may have some information as to whether she has gained, held her own or lost flesh during the time. Also please report any points of interest that you may observe about them.

When you or your society have completed your observations, please state what value this method has, and in what manner you would apply it in practice upon your farms.

Yours truly,

(Signed) L. B. ARNOLD.

Upon this suggestion the president appointed a committee to take observations. They were composed as follows: E. L. M'Cullough, chairman, Stockton; Dr. George S. Harrison, Sinclearville; Philip Lazell, Stockton; Chauncey Warren, Stockton; Dr. D. G. Pickett, Stockton; O. C. Blodgett, Pomfret.

REPORT OF MEAL FEEDING COMMITTEE.

To the President of the New York Dairymen's Association:

Your committee appointed to note the result of exclusive meal feeding to dairy cows, respectfully report as follows:

We have from time to time visited L. W. Miller's herd of dairy cows in Stockton, N. Y., during the winter while being fed on meal, and after they were put back again on hay.

They are for size and general appearance about an average lot of Chautauqua county native cows; average live weight about 900 pounds.

The herd were fed exclusively upon corn meal for 7 (seven) weeks; each animal according to its digestive capacity, making an average of about 3 (three) quarts of meal per day for each cow.

During this time the following points were apparent:

The cows did not ruminate. Were very quiet, did not evince any inordinate desire for food when hay was shown them; not so much as is displayed by cows that are fed on hay alone, in the usual way of feeding, a

little less than they will eat. Were much more quiet than cows fed mostly on meal with a small feeding of hay; say 4 to 5 pounds per day. We could not discover any signs of suffering or unrest in any way whatever.

That by comparing their condition at the time of going on to meal with their condition at the time of going back again to hay, we could not discover that they had either lost or gained in weight of flesh. That visiting them again after thirteen days on hay we could not discover anything about them that would denote but that they had been wintered in the usual way; were then filled up again like other cows; their stomachs sufficiently distended for digesting hay and were ruminating in the usual manner.

We also find that the calves dropped from these cows are of more than ordinary size, fleshy, strong, active and healthy, and that in parturition, cases of retention of the placenta are unusually rare.

That these cows have been treated in this way for several winters at a greater or less length of time each year, and by referring to notes from cheese factory records, we discover that they sometimes produce more milk per day than any other herd; last July, for instance, being a daily yield per cow of 29 lbs. 3 oz., or 1 lb. 11 oz. per cow more than any other herd.

From affidavits placed before us by persons who have observed the point in years past, we find that such meal fed cows, when turned to grass, take on flesh faster than those wintered in the usual way, other conditions being equal.

Signed—E. L. M'Cullough, Philip Lasell, Chauncy Warren, D. G. Pickett, Geo. S. Harrison, O. C. Blodgett.

JAMESTOWN, N. Y., *May* 10, 1876.

PROF. L. B. ARNOLD:—I herewith hand you report of committee on meal feeding on the "Miller plan."

Let me say that I have met with them several times, and I fully concur in their report.

You ask us the question, "How will we apply this method to our practical business?"

I will answer by saying, (1) should I find in the fall of 1876, that I lacked feed for my thirty or forty cows for thirty or forty days, I should not sell off a per cent. of those cows; nor should I buy hay; nor should I cut down on their daily feed of hay and add a little daily ration of grain with the hay to make it "go further;" but when my cows were all dried off, should keep them on the meal exclusively for the thirty or forty days, and then go back to hay again. Other ways of making this method useful to us will readily occur. Thus we may keep more stock with a given amount of meadow land, or we may utilize the corn crop in the place of

hay at any time when the meal would be cheaper than hay. Many ways will occur to us as to how to utilize a fact in nature when it has once been discovered.

Again, should a June frost sweep off 70 per cent. of our hay crop as in years past, our 50,000 cows would not be sacrificed down to a minimum, but they would be all carried safely through. I am of the opinion that when Mr. Miller's rules are followed in this matter as laid down in his treatise on "Meal Feeding and Animal Digestion," that not only is meal feeding cheap, safe and reliable, but we have some evidence to show that the treatment goes to improve the after milk production of the cow. On this point please let me remind you that this Miller herd of cows, although only an average lot to appearance, often outstrip the premium herds of Stockton, in quantity of milk given the summer after being fed on meal. Of course other causes may produce this result. They may have better grass, (not very likely,) or they may be milked with more precision and treated more kindly, only probable,) or perhaps they would beat the other herds under exact like surroundings; but the fact at least does not argue that meal feeding is detrimental to after milk production. On this point we have the result of Thomas Line's experiment, that also points in the same direction. He fed a herd of cows on meal exclusively from about March 1st till grass grew. The result was that the cows gave a large yield of butter the following summer. Therefore putting the results so far obtained all together, we can not well resist the logical conclusion that exclusive meal feeding has a tendency to influence both the animal after milk production, and her capacity for laying on fat when changed back to other feed. Other questions occur in this connection. What would be the result on her length of life if this course was followed every season? Would she live a greater number of years or would she die younger? What would be the effect upon her race if they were kept in this way for a number of successive generations? Would you thereby build up a breed of better milkers, or would they deteriorate after the first generation in their milking qualities? It is quite an easy matter for a class of minds to settle all these questions beforehand by a system of guessing; or as we might say, "deciding the case before the facts are all in." In order to bring in the facts I hereby suggest that Mr. Miller continue to pursue this course, and to raise calves from such cows and in turn the calves again from them, and in this way settle the question not only as to what the immediate but also the remote effect may be upon such a race. These and many other points are liable to be brought out, following the first discovery of the main fact; namely, that a ruminant may be fed in such a way as to suspend rumination for a time without detriment to the animal.

In the future there will be a greater number of animals kept in this manner in this county, and our opportunity for observations more extended; and I shall take great pleasure in assisting to carry out any system of taking such observations as you may suggest.

Yours respectfully,

FLINT BLANCHARD.

To Prof. L. B. Arnold, Sec. American Dairymen's Association, Rochester, N. Y.

DAIRY SPECTACLES.

BY FLINT BLANCHARD, PRES'T WESTERN N. Y. DAIRYMEN'S ASSOCIATION, JAMESTOWN, NEW YORK.

Sight, next to the sense of feeling is the most important of the senses.

There is what may be called hind (or back) sight, foresight, short sight, long sight, clear sight, dim sight, insight and a sight which sees not.

Spectacles are used to correct some defect of vision.

The lenses used are for changing the course of the rays of light, and thus magnifying or otherwise modifying vision. In other words they are designed to aid the eye.

Dairymen more than any other class of persons need the best of sight, and the sooner many of them begin to use spectacles, the better it will be for their pockets and the people.

Hind sight is the most perplexing of all vision, because it shows such deceptive foresight.

How often do we hear it said, "If my foresight were only as good as my hind sight, I should soon be rich."

I know of no way of aiding this sight except by improving it by the lessons of experience. The most of our mistakes are the result of defective vision. Sometimes we need a concave lens, sometimes the convex, and then again we need the plano-concave or plano-convex.

Every defective vision of whatever name or kind may be aided though perhaps not rendered perfect by science and experience.

Foresight is equivalent to forethought, and may be improved by observation, thought and study. This we need in every branch of business if we would be successful.

Let us take a view of the cow. How many of us dairymen know all there is in her? She is called a machine for the production of milk. Like a machine she needs care and propelling power, and a skillful hand to manage her. A poor machine does poor work with the best of power. Although a portion of the friction may be overcome by lubrication or over-balanced by increase of power, yet in order to success we want good machines as well as plenty of power.

So with the cow. She must be a good milker naturally, she must have plenty of good, clean wholesome food, and a careful hand to look after her wants and keep her in order. This is her propelling power; without this she is just as unprofitable as a machine with just enough power to move it,

but not enough to work it. A little addition of power to either gives the profit.

Perfect machines, well operated, will turn out perfect work—but this is not all; the goods polished, varnished and finished and then nicely packed for market.

So it is with milk. It may be perfect in all its constituents, and yet with unskillful handling it will produce poor butter or cheese. I fear that too many of our dairymen do not comprehend the importance of handling milk properly. They, in too many cases, make this a secondary object, when in fact all depends upon it, because you may have the best of milk and easily spoil it by handling. Being the most important business of the dairy farm it is regarded only as a trifling chore. How often it is said, "we must hurry up the chores so as to get out to work." Five minutes time may often prevent a batch of twenty-five pounds of butter coming "soft," and may save you five cents a pound in its value.

We plow and sow, reap and mow, and cart manure, and dig stone, build barns, and clear up our farms, to keep the cow, working all day and all summer for the milk in the pail—here we find the result of our labor, and here more than anywhere else we need the spectacles.

From this point we may reckon our profit or loss. I really believe the difference between the price of fine butter and the inferior grades would pay the taxes on the dairy farms of this country.

The greater part of this loss may be traced to hurry, stupidity and carelessness.

There is another matter on which we need to have our sight improved in these times of cash and credit, that is the time and manner of marketing our dairy products.

Many have of late been using very expensive spectacles, and perhaps do not need a cheaper sort.

There are undoubtedly very many commission houses which it is safe to patronize.

On the other hand there are many that are bogus, and a farmer is not supposed to know, nor has he the means of knowing which are reliable and which are not.

With the competition there is among buyers, in almost every town, he can sell his goods for about all the market will warrant.

So we say it is best as a rule to sell at home, and further get your pay when you deliver your goods, and on the other hand when you buy, pay for your goods when you receive them.

Short sighted dairymen are very numerous. Among them are those who always try to be sharp by holding their goods for a higher price than their neighbors get.

As a rule it is best to sell when the article is ready for market, and a buyer is at hand. Observation teaches us that those who follow this rule are the gainers in the long run.

Many are short sighted in buying dairy stock. They buy cows because they can be bought cheap, without regard to quality.

This class of dairymen are likely also to winter their cows cheaply. They think a cow is a cow, whether she gives 20 or 40 pounds of milk per day.

They are careless in the construction of the milk-house (if they have any) or if factory patrons, deliver their milk at the factory in bad order, in their short sightedness, failing to see that for every neglect in these matters they will pay dearly in the end.

Far sighted and clear sighted dairymen, are those who succeed in their business. They have an eye to business, and are always ready to learn. Their spectacles are always well adjusted and in constant use, and with their aid they are enabled to seize favorable opportunities and secure success.

Another class have eyes but see not. They need the lens of a telescope for one eye, and that of the microscope for the other. Everything with them is out of proportion and out of focus, either too near or too remote. They fail to see things when others see them or *as* others see them. They go on extremes. If they are offered 40 cents for butter they think they can get 50 cents, and when it drops below 40 cents they hold till spring, and then take what they can get, generally a low price. They cannot see why others succeed in getting better prices than themselves, and why their neighbors make money dairying while they fail to make it pay.

They don't see the use of so much talk about the simple matter of dairying. It's just as easy to run a dairy as to slip down on an orange peel, and in their case very much like it. They fail to see that their blindness is self inflicted. If they could be provided with spectacles which would regulate their distorted vision and bring extremes together, they could wear them with profit.

Insight is the key to success, and can only be obtained by close observation, study and thought. We are familiar with what is on the surface, but to succeed in life we must be able to *see the things that are under the surface*. There are too many superficial dairymen. We can all milk cows and make butter, after a manner, but to do it properly and profitably requires insight.

There is no good reason why there should be so great a difference in quality and quantity of dairy goods in the same neighborhood. There is no habit that costs so dearly as carelessness and superficiality in the management of our dairies. Good goods find a ready market, and generally at

remunerative prices, while inferior goods sell slow and always at a loss, for it should be remembered that the best butter or cheese costs no more to make it than the poorest, and frequently not nearly so much.

From milking the cow to the marketing of the butter, no more labor is spent in making the 40 cent butter than the 15 cent butter, and no more milk used. It requires a good deal of skill to make the best and secure the greatest yield.

Those dairymen who make 300 pounds of butter, per cow, say that the extra expense per head for feed and care does not exceed $12. Estimating 200 pounds as the yield of common dairies, and this is too high an estimate, and calling 30 cents per pound the price of butter, we have a profit above extra cost of $18 for the 100 pounds extra yield of butter. By this extra outlay, judiciously made, we may not only make more money per cow, but can keep more cows on the farm. By sowing corn and clover we can insure ourselves against drought or a short hay crop. Our best dairymen prepare themselves in this way and in other ways for any emergency. Looking forward to a possible need they get ready to meet it.

We hear it said by some that these associations have accomplished their mission, that they have taken up butter and cheese making in detail and brought out all the points connected with it; that the cow and her food have been analyzed, so that we know the kind and quantity of food required to bring the best results; that the different breeds have been discussed and the advocates of each have had their say, so that the points of excellence of each are familiar to us all; that the construction of barns, stables, milk houses and cheese-curing rooms, have all been canvassed, and we have nothing more of this to do.

Now, supposing all this to be true, that we knew the correct theory to perfection—which would be a rash assumption indeed—yet so long as we are prone to negligence and heedlessness, and fail to put the right theory into thorough practice, there is a want which these associations must meet, and a work that they must do. We need exhortation to do what we know we ought to do. We need, as the preachers say, a personal application of the truth. Nothing short of the most thorough application of truth in our practice will secure the dairymen's success, but this will do it

It has been and will continue to be the mission of these associations to promote this end, and until we are able to supply our markets with a greater proportion of fancy goods, until we can learn to keep up the milking capacity of our dairies to a higher standard than at present, until the average dairyman shall have become more intelligent in regard to his own business, the mission of these associations will not be ended.

Here is a point where many dairymen need spectacles to enable them to see an advantage in relieving their wives and daughters from the care and

drudgery of butter making by patronizing the factories, even if they should not receive quite as many dollars and cents for their milk. The factory plan is an improvement in this if in nothing else, that it enables one person to do the work of ten, and thus relieves our over-worked wives and gives them the respite they have so long sighed for and so much needed.

The farmer's wife has enough to do without the care of the dairy; then give her such rest as you can give her, and not grudgingly, and thus prolong her life and increase her enjoyment of it, as well as your own. This is "a consummation devoutly to be wished for," and I know of no better way to accomplish this desirable end than for farmers to bring their wives to these meetings, and give them opportunity and a voice in these discussions. They feel no less than yourselves an interest in these matters and should be urged to express their opinions in these deliberations.

The factory system has opened up for us a foreign trade which could scarcely have been done by the dairy system. Factory cheese is sought after by all cheese eaters, and commands a high price, and so long as the standard of American cheese is kept up where it now is or exalted still higher, as it is most likely will be, we shall have a foreign demand which will take all our surplus product at remunerative prices.

It requires but half an eye to see that it would be ruinous to our interests to allow our standard of quality to be lowered by any process whatever. We need nothing better than leather spectacles to see that we must bend all our energies to make still further progress if we would compete successfully in the markets of the world. The last quarter of a century has seen great improvement in dairy practice.

In 1850, an American traveler in Gloucestershire inquired of an eminent dairywoman what method she adopted to prevent cheese from heaving and and bursting, and was told that *they sometimes put in a little white lead, but not much.*

In Cheshire it was customary to put in a handful of pins in the centre of the cheese to create a mouldiness and give it the appearance of age. The same writer adds that "with these and other ingenious medicaments applied to our food, we have great reason to exclaim in respect to our bodies with good Dr. Watts,

'Strange that a harp of thousand strings
Should keep in tune so long."

We can by carelessness in the curing room provide our customers with pins—the world moves; it is no longer unlawful for mothers to kiss their children on Sunday.

We see by the interest taken in these discussions, that dairymen are awake to the importance of their interests. Improvement is their motto, and as long as they keep clear of the idea that they have learned all there

is worth knowing, they will continue to improve. The future dairyman will be a model man in more respects than one.

When a boy I used to drive team over the hills of Chautauqua, and I could tell a dairy farm as soon as I came in sight of it There were visible signs of thrift which could not be seen upon other farms. The buildings and fences were better, the crops looked better, because better attended. From that day to the present, I have never known a dairyman to fail who attended to his business intelligently and kept his spectacles in order. Prices may fluctuate, so they do in everything, but dairy goods always sell for cash, at some price, when put upon the market in any quantities, which is not true of most other products.

What is needed now to render the business more profitable, is to make an article so good that people will eat more of it, and thus increase the demand.

All attempts to counterfeit should be discontinued. I can see no good reason for coloring butter or cheese more than lard. Color adds nothing to the flavor or nutriment. Grass and corn meal will produce both.

Oleomargarine has come to grief, not so much because there is no value in it, as because it trained under false colors. It is like the old State bank bills, the farther it gets from home, the greater the discount.

We soon tire of shoddy, in whatever form it presents itself. The demand for good goods at good prices increases, while the demand for poor goods, even at poor prices, is waning.

In some manufactures a cheap article may be made cheaply of cheap material, to meet a certain demand, and at the same time realize a profit, but not so with the products of the dairy. Of course the cost of material depends somewhat on circumstances, as price of land and cows and hay, but we cannot have any special low priced material, for the reason that poor milk costs as much in its production as the best. If it cost thirty cents to make a pound of butter that is worth thirty cents, it costs not a farthing more to make a pound that is worth and will bring forty cents.

The whole question of profit or loss can be summed up in a few sentences. 1st. A farm adapted to the business. 2d. Cows adapted to the business, and whose feed and care is adapted to the business. 3d. The proper handling of the milk, proper manufacture and handling of the goods when made.

These are the essentials to success in dairying, and the spectacles which will best aid us in the work, are such as give us a clear and correct vision of the world before us, and on all sides of us, as well as behind us. A clear head and active brain, an honest heart and an industrious hand, these are the implements with which, under ordinary circumstances, success may be acheived.

MILK SECRETION.

BY PROF. L. B. ARNOLD, ROCHESTER, N. Y.

Dairy husbandry opens a wide field for investigation. The philosophy of dairying connects itself first with soil and climate. The grass which is to be converted into milk, is varied in its composition and qualities by the soil on which it grows. Grass grown upon a poor soil is quite different from that grown upon a rich one, and every modification in the composition of a soil makes a corresponding modification in the vegetation growing upon it. The roots of herbage, drawing their nutriment from different materials, not only build up vegetation of variable constituents, but the same materials are differently elaborated according as the season is wet or dry, hot or cold. To be intelligent in his calling, a dairyman must know his ground, and the modifications of moisture and climate upon the herbage which is to form the basis of his operations. He will have occasion to draw upon geology, mineralogy, botany and climatology, to develop properly the vegetation which is to form the raw material for his animal machines to work into products.

The philosophy of dairying calls also for a knowledge of the animal as well as of the vegetable and mineral kingdoms. The anatomy and physiology of the cow, the laws of digestion, circulation, nutrition and secretion, and excretion must be studied, and also the extent to which they can, through habit and the laws of hereditary descent, be molded to his use. All the phenomena of life have their application in the business of the intelligent dairyman, and the boundless fields of chemistry and physics are the dexter instruments which are in every day use in all his operations. All this is applicable in turning soil into vegetation, and vegetation into milk. When we come to the study of milk itself, with a view to understanding all the changes which may be rung upon it in moulding it into products, new fields of inquiry open before us, till we can see no bounds to them.

Practical, progressive, and philosophical dairying calls for extensive knowledge and profound thought. The constant, close and thoughtful observation necessary to all its operations leads to investigation in search of new truths demanded to subserve its purposes. The facts which are garnered for profit become the basis of logical reasoning, and while they open the way to new light, they invite to the study and comprehension of general laws. It is a peculiarity of modern dairying that there is something in the nature of its study and practice which tends to draw out and develop

the minds of its devotees, and it is this peculiarity which is putting it ahead of its sister rural industries.

From the wide range of study spread out before us, I have selected for the present occasion but a single point, to wit: the secretion of milk. This has as yet received but little attention, the main study of dairy students having been chiefly directed to the more practical operations of manipulating and manufacturing milk after it has been produced.

We may get a better idea of the nature of milk secretion if we go back a little, and look over the formation and composition of the material from which, and of which, the secretion is to be made.

The functions of the animal kingdom are somewhat different from those of the vegetable. The latter creates new compounds which were not in existence before. It forms proteine which builds up the tissues of animal bodies, and carbo-hydrates which furnish fat and suppor animal respiration. The animal kingdom creates nothing, but draws its support from the vegetable world. It is true there are no bones, brains, or flesh, in the vegetable kingdom, but the organic matter of which the different parts of the animal are composed were originated by vegetable life. The animal kingdom is only an artificer. The vegetable kingdom creates, so to speak, the timber for a superstructure The animal fashions that timber into a building, and though it now appears in a different form, it is nothing new. It was timber when the artificer took it, and it is the same after it has been used. The bones, brains, flesh and vicera, are only varieties of building material fashioned into an animal structure.

The material of which the animal is made up was proteine and carbo-hydrates to begin with, and it is proteine and carbo hydrates when it is done.

Besides the compounds in plants which go to make up and sustain animal bodies, plants contain other matter—mineral and fibrous—which does not enter into their composition or use. It is the business of digestion to dissolve out and separate the parts to be used, from those which are not used for animal support. Digestion makes no new creation of food; it simply separates and sends into the blood such parts as can be used with little or no alteration. Vegetable substances are often passed into animal structures without any change at all. Chemists tell us that vegetable albumen and fibrin are the same as animal albumen and fibrin; and vegetable caseine and animal caseine are so nearly alike, that beans and peas, which contain much caseine, can, when properly treated, be made to acquire a cheesy taste, the same as the caseine you are in the habit of separating from milk. Some of the fatty matters in plants are also used without any change, while others are slightly modified. The blood of animals is therefore made up of the constituents of plants, including albuminoids, carbo-hydrates, certain mineral matters, and water—all of which are used to

build up animal structures, and out of which all the animal secretions are made, of which milk is one.

With these general remarks concerning the ultimate derivation of blood from the vegetable kingdom, and as the basis of all the secretions, we will now turn our attention more directly to the secretion of milk. But I will first remark that what is meant by the term secretion is a product derived from the blood by a peculiar combination or arrangement of cells, the aggregation of which is called a gland. A secretion is different from blood. It may not be amiss here to say that an animal cell is the most minute division of the animal structure, and is composed of a membraneous sac with something inside of it, which is supposed to get in there by straining through the walls of the cell. Some cells contain only a watery serum; others contain fatty matter; those which make up the hard structures of the body contain bone material, and so on. The cells which make the lacteal or milk glands are largely filled with fatty matter.

The blood, as you probably all know, moves from the heart and lungs to every part of the system in vessels called arteries, which divide and subdivide till they terminate in thread-like tubes, invisible to the unaided eye and finally terminate in a filamentary structure, and after passing this structure are again concentrated into tubular vessels called veins, in which the blood goes back to the heart and lungs to complete another round, and so on to the end of life. The minute pores through which the blood strains in passing from the arteries to the veins, are called capillaries, and it is in its passage through these capillaries that the secretions are drawn out and also the nutrient matter for assimilation. This capillary structure permeates every part of the animal body, and supplies the glands and every other part of the body with blood. Out of the matter the gland secretes from the blood in the capillary structure, cells are grown which make up the main substance of the gland. In taking matter from the blood, each gland is supposed to take out according to its nature only certain elements of the blood. As only certain substances enter into the composition of cells, whatever else may come from the blood with the material of the cells, will be left as a residue, and must have a definite and peculiar composition according to what was taken from the blood in the first place and what has been used in the special growth of cells. Hence, the difference in the products collected or given off from the different glands of the animal body. The salivary glands thus furnish saliva, the liver bile, and the kidneys and milk glands each a peculiar fluid.

The action of some glands is constant—like the liver and kidneys—others have periods of activity and depression, as the salivary glands which act very feebly, except when the mastication of food is going on, when they discharge copiously. The lachrymal glands ordinarily secrete only fluid

enough to moisten the eye, but when affected from grief they pour forth a flood of tears. When left to their natural course milk glands act similarily. They have periods of activity and repose. As grief exerts a sympathetic influence over the lachrymal glands, so does the active state of the re-productive organs exert a controlling influence over the lacteal glands. Until this influence comes into activity, the milk glands exist only in a rudimentary condition. An increased flow of blood to, and activity in, one set of organs, is followed by a corresponding flow of blood to, and activity in, the other. And this sympathetic control continues till the full and complete activity and development of one function brings about the perfect action and development of the other, and when the cause of that controlling influence has been removed, from that moment the organs affected by that influence begin to abate their activity till they gradually fall back to a state of repose.

DESCRIPTION OF UDDER.

As the form of a tool is indicative of the purpose it was made to serve, so the anatomical structure of an organ in an animal body affords an evidence of the function it was made to execute. The study of the udder therefore is one of the most direct and efficient means of studying the way in which the secretion of milk is effected. I shall not assume the task of unraveling all the mysteries of milk secretion, but having given some attention to the structure of the udder, I shall venture a few observations descriptive of that organ, in hopes that what has prove very interesting to me, may at least afford something of interest to others.

The extraordinary development of the mammary glands upon the domestic cow, is to a large extent, the work of art, since nature furnished only enough with which to elaborate food for the offspring. As art does not always use precisely the same means, it does not always lead in precisely the same direction with its developments. The irregularity of art shows itself in the development of the bovine udder. It is not always uniform, externally nor internally. It is not only different upon different breeds of cows, but it varies in different individuals of the same breed, and the corresponding parts of the same udder are not always uniform.

For the sake of giving actuality to the description, I will describe an udder taken from a choice six year old cow, four weeks from the time of calving, and in as good a condition as it could well be for examination.

Considered as a whole it was made up of four distinct glands or lobes, one for each teat, bound together by membraneous tissue, and covered by pouch of a skin in which it seemed to be suspended, and to which it was snugly bound by the same kind of tissue which attached the lobes together, and also by nerves, blood vessels, and minute tubes and tendons. While

membraneous tissue surrounds the whole, each lobe has an envelope of its own, which is attached to the others where it comes in contact with them.

An arterial branch of considerable size entered each lobe, and also several smaller ones, the origin of which was not traced, by which each quarter was supplied with blood. So far as traced, the arterial branches were neither uniform in size nor in their mode of division nor subdivision. There was an evident difference in the quanity of blood supplied to each quarter of the udder, and especially between the front and back lobes, and

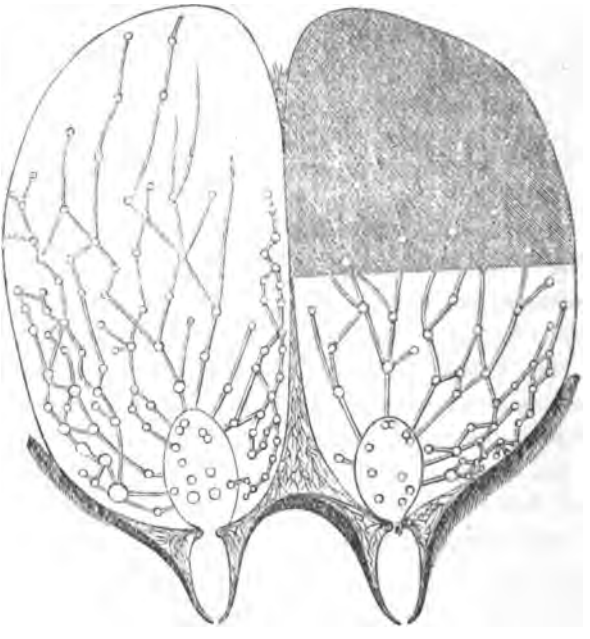


Fig. 1.

also between the two back lobes. But few observations were made upon the venous system of this specimen. The lactiferous vessels were more carefully observed. In each quarter of the udder these were entirely separated from each other, and in each were differently arranged.

Beginning at the lower end of the teats we have an aperture closed by an elastic band. Proceeding up the teat, we have in it a cavity enlarged in the middle, when injected, as seen in figure 1. At the top of three of the teats there was a diaphragm separating the cavity in each teat from a little larger cavity above it, with a hole in the middle of the diaphragm about the size of a pea. The cavities above the teats answered as little reservoirs for holding milk. That over the right hand teat, when distended, was about the size and shape of a turkey's egg with the large end down. Those of the front teats were the size and form of a hen's egg. Over the

left hind teat the diaphragm was wanting, and the cavity above opened directly into that of the teat as shown in figure 2.

From the little resevoirs at the top of the teats were tubes running in different directions through each gland, which were frequently cut off by still smaller reservoirs distributed all through each gland, as indicated in figure 1. These little reservoirs were more abundant, and larger in the lower and outer parts of each lobe, diminishing in size and frequency as they rose toward the upper part. They varied in size from a hickory nut to a pin head. There was but a single one the size of a hickory nut, the majority of them were of the size of beans or peas and so down, till they disappeared in the upper part of the udder.

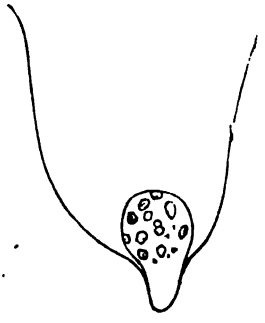


Fig. 2.

The tubes which connect the reservoirs were, some of them, larger in the middle than towards the ends, and by connecting with different reservoirs, anastomosed like blood vessels. At each end of the tubes, where they enter and where they leave the reservoirs, is a diaphragm similar to those at the top of the teats, which stretches over a part of each end of the tube, leaving, as over the teats, a hole in the middle. The diaphragms at the top of the teats and at the ends of the lactiferous tubes are all alike made by an extension of the mucous membrane lining the inside of the tube. Where it doubles over to form the edge of the aperture, it encloses a small cord which swells out the folds a little, giving the appearance of a hem running around the edge of the aperture. The contraction of this cord closes the aperture. It is a very delicate thread. It is made up, not of fleshy fibers like ordinary muscle, but of very fine elastic fiber-like spiders' webs, so fine that five hundred of them were judged to form one of these little threads. In the center of the udder and between the four glands is a large and strong tendon leading from the abdominal muscles and passing down between the four glands or lobes, where it soon divides up into branches like the brush of broom corn, which again divides and sub-divides till the threads become too fine to follow with the unaided eye.

These ramifications connect with the little cords just described and which appear to be terminations of the filaments of the tendon passing around the apertures in opposite directions, so that when the cow contracts the abdominal muscles by drawing up her abdomen as she always does when she holds up her milk, she pulls on these ramifications and closes all the apertures with one effort, and prevents the milk from flowing. It is in this way that cows hold up their milk at will. When the abdominal muscles are contracted the tubes begin to close, first in the upper part of the

bag where the apertures in the diaphragms at the ends of the tubes are very small; a more vigorous effort closes the larger ones below, the last ones to close because the largest are those at the upper end of the teats. It requires a powerful effort to draw these so tight that milk will not pass through them, but when much disturbed, there are but few cows which are not able to close them perfectly.

The minute filaments of this central tendon have attachments elsewhere than in the fibrous cords. They fasten all through the udder and in the skin, so that in holding back her milk, the whole udder is contracted and held firmly. These filamentary divisions were so extremely fine and difficult to trace that they could only be followed by dissolving away the soft parts with an acid.

In each quarter of the udder the system of tubes were found to divide and sub-divide each in a different way, so that when dissected out they were as unlike as the divisions and sub-divisions of the branches of so many different trees. They all alike start from, or empty into the reservoirs over the teats, but the number of tubes starting out were in each case different and differently located. Twenty-three tubes led out of the reservoir at the top of one hind teat, and seventeen out of the other; twenty-one started from over one forward teat, from the other side the number was less and differently arranged, showing an independent and special action in each division so far as secretions were concerned.

The bulk of the udder is made up of a mass of cells and vascular membranes, through which the lactiferous tubes penetrate. In the upper part of the glands where the structure was less disturbed with reservoirs than below, the arrangement into lobules was quite regular as in figure 3, which gives a magnified view.

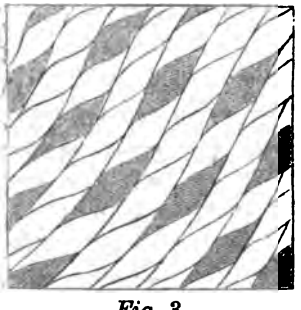


Fig. 3.

Into these lobules the lactiferous tubes ramify with great minuteness to take up the milk which the glands secrete. Magnifying one of these lobulated divisions till the ultimate follicles could be seen, we have a view as seen in figure 4. The follicles are covered with a membrane, the cells appearing upon the inside of it from which they seemed to emanate. The investigations and opinions advanced by Dr. E. L. Sturtevant, of Mass., have been very fully sustained in these examinations of the ultimate follicles, which, at twenty-eight days from the time the cow came in were in the best possible condition for studying. The gland cells, as he suggests, appear to start out of the inside of the membrane like blisters, whose contents are fat. Others follow behind them in succession, crowding them along, till the first formed separate and

are shed off like leaves in autumn, or as sucking teeth give place to those which come after them.

The liberated cells, completely enveloping a speck of fat, find their way out of the follicle through the vascular membrane which connects it with the minute terminations of the lactiferous tubes, where by the aid of the liquid part of the milk they are worked along through the system of tubes and reservoirs, till they pass out at the teat in the form of what are differently known as milk globules, cream globules, fat globules, and butter globules.

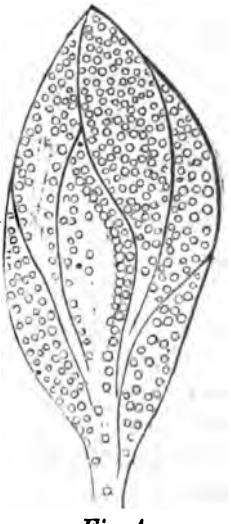


Fig. 4.

When not filled with secretions the interior cavities of the follicles collapse and make the substance of the gland appear like a solid mass, but when cut into thin slices and highly magnified, it appears extremely vascular and exposes a great extent of surface. It then appears like a net work, or sieve, through which liquics could pass with great freedom. The secretion of the liquid portion of the milk evidently proceeds very slowly, but the vast extent of surface it has to exude from, enables the udder, as a whole, to collect considerable quantities in a given time.

That the milk globules were once gland cells, is corroborated, first, by the fact that they have the same size; this was demonstrated by Dr. Sturtevant by actual measurement. Second, they have the same form; when viewing them under circumstances which would exhibit their exact form, I have found them to be alike, neither of them being exactly round. Third, the covering of the globule is a membrane, and not caseine, as many have supposed; that it is a membrane is shown by the fact, that when treated with nitrate of silver the globules give the same reaction which is given by other membranes, embracing fat, (suet,) turning them to straw color. Caseine, when treated with nitrate of silver gives a different reaction, turning black. Fourth, while it has been supposed by some, that specks of fat when floating in the liquid milk in which albumen and caseine are in solution, become coated over with solidified caseine and thus derive their delicate covering, others have supposed that the minute particles of fat become encisted while in the blood vessels, and that they are secreted from the blood ready formed. The fact that milk globules sometimes exist without containing any fat is a sufficient refutation of both of these theories. I have found that instances occur in which a part of the milk globules contained only serum, so attenuated that when dried down, the walls of the pellicle enclosing it would collapse and appear perfectly flattened, while others retained their rounded form, showing them to be filled with fat. In

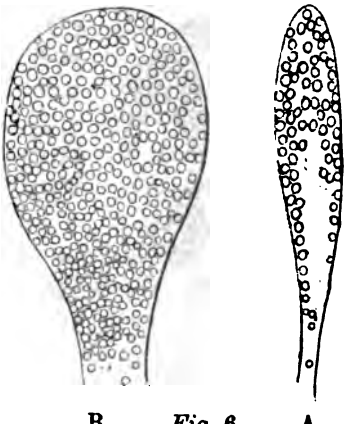
an extreme case the milk of a cow which would not make butter, had part of its globules filled with fat so that they remained round when dried, others with various degrees of depressions, but fully one-half appeared to contain no fat at all, as they were perfectly flattened by drying. In several cases the pellicles covering the serum became adherent and shrunk and tore apart in the middle from the edges sticking to the glass, showing various fractures. An enlarged view of one of these fractures is shown in figure 5.

Fig. 5.

By examining milk with the early morning sun and turning the reflector so that the globules would cast no shadow, I have been able to use a stronger light and get better views than I could with the mid-day light. Under this mode of inspecting, several cases have been met with in which a part of the globules showed no fat, while others showed to be part full, and the great bulk of them entirely full of fat. Though the gland cells of the udder are generally filled with fat, it would seem a very easy matter for some of them, under peculiar circumstances, to form without fat, and hence account for the occurrence of fatless globules in milk if the cells at length become globules, and it would be difficult to account for them in any other way.

COLUSTRUM.

In the latter part of the period of gestation, by reason of a sympathetic influence exerted upon the udder, the blood vessels leading to and from it begin to enlarge, and the circulation in it to become more active, and assimilation more rapid, its whole structure becomes increased in size, and its vessels engorged with blood. The result of this unusual activity is increased heat, and presently the formation of gland cells. These begin to form in the follicles, to the sides of which they remain attached, as in A, fig. 6.



B *Fig.* 6. A

At birth, or a little before, the liquid part of milk begins to be secreted, holding sugar, caseine, albumen, and certain mineral matters in solution, and to accumulate in the udder, when the gland cells begin to shed off, sparingly in heifers, but more freely in older cows. At first the cells appear to break off very frequently in clusters, peeling off some of the membrane of the follicle with them, as shown in figures 7 and 8, which are *fac similes* of the first milking of the cow whose udder has just been described. They were drawn by the aid of a camera and accurately engraved; they show

some large and many irregular pieces of membrane, with more or less cells attached, which, from the feverish condition of the bag at that season, sloughed off with the cells before they fully became milk globules. As the inflammation abates and the action becomes more regular, the membrane disappears, and the cells only are mingled in the milk. When these clusters no longer appear, the milk is considered fit for human use, or for manufacture into butter or cheese. Some dairymen are in the habit of saving the fifth milking; it is sometimes good, but oftener not. I give an illustration of the fifth milking of this cow, fig. 9, which seemed to be full as well as cows generally are at this time, in which specks of colustrum are seen. It often requires five or six, or more days, before they entirely disappear, according to the health of the cow and the extent of inflammation in the udder. When the milk will boil without curding, it may be regarded as fit for use. This is an efficient and convenient test of fitness for use.

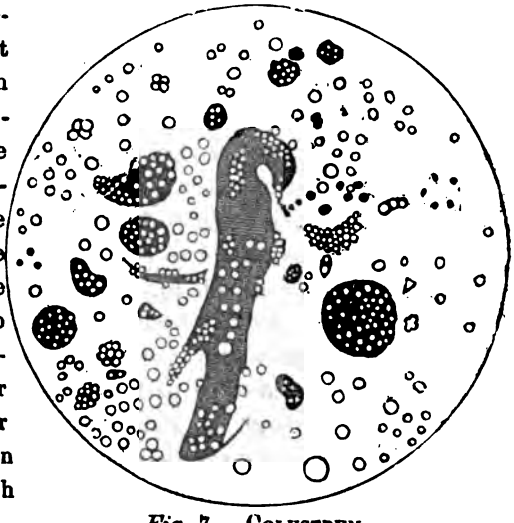


Fig. 7.—COLUSTRUM.

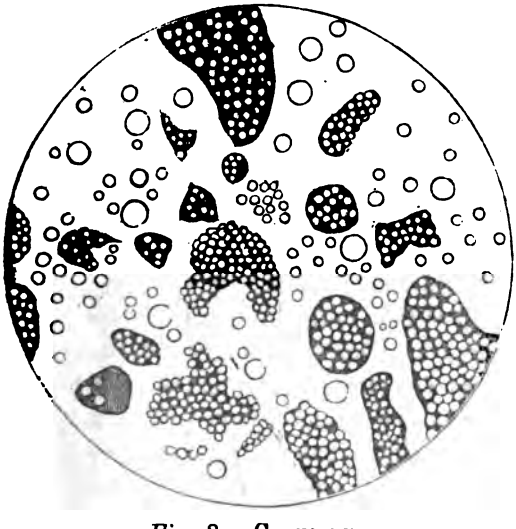


Fig. 8.—COLUSTRUM.

The analyses of colustrum vary very widely in their per cents. of fat as well as other elements. These differences are doubtless owing more to the particular condition of the udder at the time of coming in than to any other cause.

The treatment of the cow, at and previous to the birth of her offspring, has very much to do with the condition of her udder and the quality of her first milk. There can hardly be a doubt that an abundance of fat in the blood, stimulates the formation and multiplication of gland cells, and hence

milk globules, and that a paucity of fat diminishes the extent of their formation. It has been my observation for years that where cows are fed chiefly on unstimulating and flesh-forming food before coming in, such as clover hay, pea meal, bran or shorts, the bag remains pliable and soft, and if the milk is drawn out in season, there is not a very wide difference between the first milk and that which comes afterward. But if corn meal, oil meal, cotton seed meal, or other food, very rich in fat, enters very freely into the diet of cows before calving, their bags swell up to a very large size, and are hard and inflamed, the follicles become distended as in B, figure 6, because of the greatly increased number of cells which the rich food has stimulated while they are still adhering, and they become hard and inflamed, and it is difficult to reduce the inflammation afterward; the colustrum is high colored and thick, and full of cells with pieces of membrane attached, and they continue in the milk for a long time. It is not very uncommon for cases of garget, which ruin a part or the whole of the udder, to follow high feeding with food too rich in fat, before cows come in, especially in young heifers.

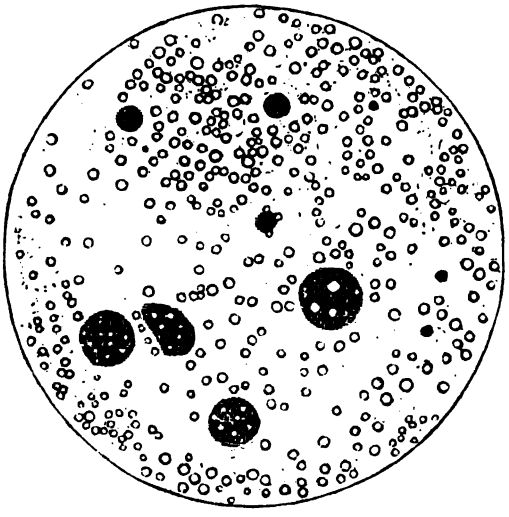


Fig. 9.—Fifth Milking.

The feed before coming in should be generous and nutritious, but it should abound in flesh-forming rather than in fat-forming elements. Early cut clover is one of the best things I have fed at such times, and corn meal and oil meal have proved the most dangerous. After cows have been in milk awhile and their bags have become reduced, corn meal and similar food may be fed with altogether different results. The fat then goes rapidly into the milk, avoiding the accumulation of cells in the udder and the inflammation which would otherwise follow. Previous to birth the same food would accumulate in the gland cells, swelling out and crowding the follicles as at B, in figure 6, because at this time the cells, though forming rapidly, are not shed.

CHANGES IN THE QUALITY OF MILK.

Colustrum is the result, in part, of inflammation in the udder, and may occur at any time during the milking season, but is less likely to occur in

the later than in the earlier stages of giving milk. When after parturition the inflammation has died away and the globules float singly and freely in the milk, it may then be said to have assumed its normal condition; but the quality of milk does not remain stationery, it is constantly varying from the time a cow comes in till the milk ceases to flow. At first, or so long as the quantity continues to increase, as it usually does for a few weeks after coming in, the per cent. of water increases, and that of cream and caseine diminishes, though the aggregate products are, by reason of the increased quantity, constantly enlarging. When the flow begins to diminish, the quality begins to improve, and it continues to grow richer till near the close of the milking season, when it again begins to depreciate, when the cow dries up before coming in again. The globules vary in size, diminishing as the distance from the time of calving increases, or rather as the amount of secretion diminishes, for if by an abundance of rich food the flow can be kept up, the globules may retain their size.

The quality of milk varies with the quality and supply of food; if it is very succulent the water increases in the milk, but the increase of water cannot go beyond a certain limit, 90.5 water and 9.5 solids is the extreme limit I have met with by succulence and moisture in the food. On the other hand, by the use of food rich in the clements of milk and other circumstances favorable, the extreme limit in the opposite direction has been 81.5 water and 18.5 solids. The former occurred in June, with a feed of grass and brewer's grains, the latter in the fall with after feed and meal.

The aggregate results of cheese and butter factories demonstrate this rule on a large scale.

The variations of milk through the season are different, according to the condition and feed of the cows. The milk of cows having insufficient food or of poor quality, not only give less milk, but what they do give is poorer in quality than the milk of cows well fed. The difference in quality caused by difference in feed, is much wider than dairymen are apt to suspect, and it often amounts to great injustice in the division of the proceeds of factories.

In testing the milk of the different patrons of a factory by curding equal weight of their milk, and drying and weighing the curd, I have found the milk from one dairy to make twenty-seven per cent. more curd than the same quantity of milk from another dairy delivered the same day, both being sound and pure.

Ten to fifteen per cent. in the value of milk for cheese making is a very common difference in the latter part of the season, a difference due wholly to quality and supply of feed. The wide variations which occur from this cause should be more carefully studied by dairymen, and some more exact mode of apportioning the proceeds of factories be devised. The least in-

jury done to the patrons by way of watering milk or skimming, or saving out strippings, will receive the most prompt attention and punishment, whenever detected, and a most watchful care is always on the alert to guard against unjust loss in any of these ways; but one patron may bring milk which will make fifteen per cent. less cheese than that of another, and yet they divide equally and without complaint or suspicion of anything wrong. If the present inequality in the value of milk, especially for cheese making were fully understood, it would not long be tolerated. The remedy is easy as will be shown in another place.

Other circumstances than those of feed affect the quality of milk; pregnancy is one of these circumstances. Of two cows giving milk alike at the start and continuing alike in respect to food and other conditions, except that one becomes pregnant and the other not, the one becoming with calf will soon begin to fail in the quality of her milk as compared with the farrow cow, and the further advanced in the period of gestation, the wider will be the difference in their milk. The milk of spayed cows is least affected by distance from the time of coming in. But whatever may be the situation of the cow, her milk will fail after a time. In a few exceptional cases, cows continue to give milk continually for a series of years, whether breeding or not.

The milk producing function is brought into activity from an extraordinary amount of blood driven into the udder by an enlargement of the arteries leading to it, the enlargement being occasioned by a sympathetic influence from the active state of the reproductive organs. The increased size of the arteries being due to certain conditions, it is reasonable to expect that when the conditions have ceased to exist, the arteries would gradually fall back to their former size and activity, or nearly so, and this they do unless means are used to prolong their expansion and activity. As time advances, the stimulus being removed, the arteries by degrees diminish in size, and the supply of blood to the udder becomes less and less, till finally, it falls back to its normal standard, and the flow of milk keeps pace with this influx of blood, and the cow dries of her milk when the extra influx ceases.

But the contraction of the arteries leading to the udder is in a measure under the control of the dairyman; he can retard or hasten it at will. By causing the milk to be frequently removed from the udder he creates, as it were, a vacuum into which the pressure of blood in the arteries drives forward the newly forming milk to fill. The reaction of pressure in the milk tubes upon the arteries which supply the blood from which to elaborate milk to fill them when exhausted, is both direct and large. So directly are the milk tubes and arteries connected, that by injecting one-quarter of an udder with water and subjecting it to strong hydrostatic pressure, I

have been able to drive water through the milk tubes into the arteries so rapidly as to make it drip in a stream from the main artery supplying that quarter of the bag with blood. The direct effect of relieving or not relieving the milk tubes of their contents is to hasten or retard the passage of blood toward the udder, keeping up their expansion by an active passage of blood in one case, and allowing of contraction in the other, by retarding the motion and diminishing the quantity of blood passing through them.

Frequent, perfect, and regular milking, is therefore a very efficient means of promoting the flow of milk and preventing change in its quality, for so long as a large flow can be maintained so long will it maintain its earlier characteristics.

The secretion of milk has a tendency to diminish the volume of blood by drawing both upon its liquid and solid elements. To keep up a flow of milk, this draft must be supplied by furnishing enough to restore the steady waste. A failure to do this for any considerable time, is not only to decrease the yield of milk during the lack of food, but to invite a hurried contraction of the blood vessels connected with the udder. These once reduced, there is no enlarging them again till the occasion of another birth, and the supply of blood for making milk will be diminished to their reduced capacity, keeping down the flow permanently and shortening the time of its final cessation.

Immense losses are sustained every year by dairymen from not comprehending this fact with sufficient clearness. A lack of feed in the midsummer drought where shrinking has already begun, hurries the shrinking along; lasting several weeks, the reduction becomes permanent, and must remain the rest of the season. No after feeding can restore the former activity of the glands, for the vessels supplying them with blood have become reduced. The great value of soiling, when grass fails, lies in keeping up and prolonging the action of the mammary glands. The dairyman who appreciates this will never let his milch cows lack for food or drink.

An instance will illustrate the effect of a defective supply of food upon the milk-secreting vessels. In visiting the farm of the Hon. Harris Lewis, in the fall of 1873, I found his cows, after the severe drought of that summer, giving an average of twenty-two pounds of milk a day; his heifers and farrow cows giving thirteen pounds a day, and his other cows twenty-four pounds each. Though the rains had come and the grass had revived, the average at the factories around him, where soiling had not been adopted, was thirteen pounds to the cow—just equal to Mr. L.'s heifers and farrow cows. The soiling more than paid for the cost in the dry season, and in the fall the large yield gave larger profits. But many dairymen complained

that year that their cows did not pay for their keeping. The reader may possibly see why.

Variations in the quality of milk during the main part of the milking season are gradual, and for the most part can only be noticed by comparing milk at remote periods from each other. When such comparisons are made it will be found that the liquid part of the milk becomes less and less transparent, till toward the close of a long period of milk-giving, it becomes only translucent, and more or less of the caseine becomes solid and remains in minute particles suspended in the liquid like milk globules, but which upon standing, tend downward instead of upward. Opacity is also increased by a change in the condition of the fats and sugar. A part of the fats and probably the sugar, appear as glycerides, preventing the formation of the butter. At this time it assumes a somewhat gelatinous appearance, and something of an elastic consistency, so that it does not spread well upon the glass but draws itself up into bunches, as in figure 10, which is a view of milk near the time of drying up, and which would not make butter. The globules were scanty and very small. Though perfectly sweet when freshly drawn, it contained many particles of solid casiene, and was full of cloudy streaks, more or less dark, but not so dark as the figure indicates.

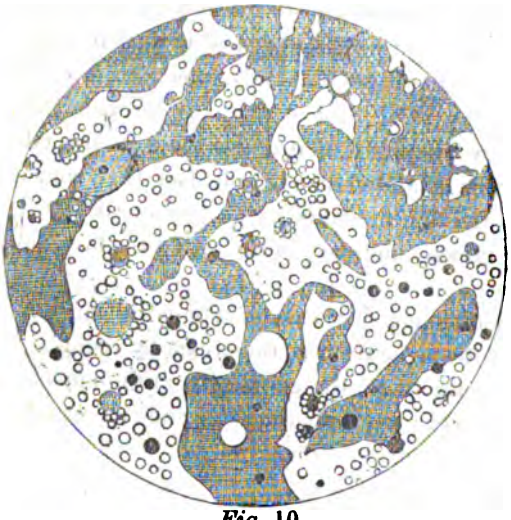


Fig. 10.

The quality of milk is affected by the frequency or remoteness of the time of milking. In trials of milking once, twice, three times and five times a day, the most frequent milking gave the richest milk. Milking every twelve hours, gave 12½ per cent. cream; milking once in three hours gave 17½ per cent.

The difference in the quality which may sometimes be observed between the morning's and evening's mess, is chiefly due to unequal distance of time between milking—the milk being richer at night when the days are short, and richer in the morning when the nights are short. When the times between milkings are equal, the yield and quality have proved to be similar. A difference sometimes occurs where cows are more comfortable and quiet during the night than during the day, or the reverse, as when

suffering by cold in winter, or by flies in summer, when more and richer milk follows the greater comfort.

There is a well known difference between the first and last part of a milking. This is generally but erroneously supposed to be due to the rising of the richer part of the milk to the top of the udder; but no such circumstance could occur. All the motion milk is susceptible of in the udder, is from the follicles forward towards the teats. It can not possibly move from the teats backward toward the follicles or ramification of the lactiferous tubes. As has been already mentioned the ends of the milk tubes, where they connect with the little reservoirs, are capped with diaphragms. These, except at milking time, are kept constantly closed, so that milk, as it comes from the extremities of the tubes, can only pass into the reservoirs with which they connect, by being pushed along by the milk that is forming behind it. The theory, therefore, that cream rises in the udder must be entirely fallacious. It is confuted also by the fact that woman's milk, in this respect, exhibits the same peculiarity as cow's milk, the last being the richest; but if the cream could rise in the gland the last ought to be the poorest.

The difference between the first and last part of a milking must have some other origin than that of the separation of the cream by rising.

In the udder which has been described, the gland cells in the upper part were larger than those in the lower part, indicating that the richest part of the milk was secreted there, and as this would naturally be the last to come out, it would seem to account, in part at least, for the greater richness of the last part of the milking; but as no other udder has, that I am aware of, been examined with reference to this difference in its cells, it would be unsafe to make a general inference from this one case, though it is quite likely a general fact.

Again, milk loses in quality by absorption while lying in the udder. That milk loses considerable from this cause, is evident from the fact, that when the flow is small it is all taken up in this way. Judging from the rough and jagged appearance of the globules which have lain long in the bag, the cream, especially, appears to suffer, but just to what extent it loses in this way, it is not easy to determine.

Thirdly, it must be evident that the milk globules, being solids, would meet with more resistance and make less progress, in passing through fine tubes, whose sides collapse, or lie against each other, than the purely liquid part of the milk would, and hence that they would fall behind the liquid portions of the milk in their journeys toward the teats. The larger globules would meet with more resistance and come forward slower than the smaller ones, and hence come out last, making the last part of a mess the best as well as the richest. Dr. Sturtevant thinks this cause sufficient to account

for all the differences between the first and last part of the milking, and it certainly could not fail to make a very wide difference.

MILK AFFECTED BY BREED.

It is rare, if not impossible, to find two cows in any herd whose milk will be exactly alike. Each animal has a constitution peculiar to itself, and the milk secretion is moulded, in each case, by that constitution. There can be no doubt that all the elements of milk are modified by the constitutional peculiarities of the case, but observations have yet been almost exclusively confined to the fats, and these even have been but little investigated. Cows have similar constitutions give milk similar in quality, hence the milk of a breed has an approximate uniformity in its characteristics. Thus in the milk of Jersey and Devon cows generally, the fat is deeply colored and abundant, and the globules are very large and comparatively uniform in size. Figure 11 is an illustration of average Jersey milk, in which it will be seen that the globules are large with but few small ones.

Dr. Sturtevant was the first to call attention to the size of butter globules in different breeds, and to him I am indebted for figures 11, 12 and 13.

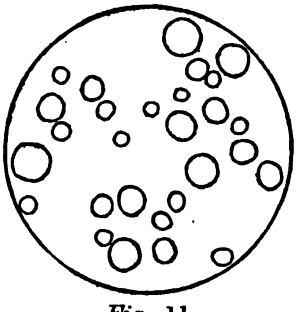


Fig. 11.

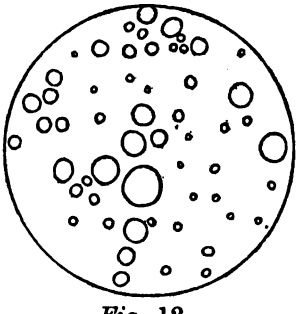


Fig. 12.

The flavor of Jersey butter is as characteristic as the appearance of its butter globules, and that of the Devons scarcely less so. In the milk of Ayrshire cows the globules are smaller, and in size unequal, a circumstance which is also quite common in the milk of native cows. For view of Ayrshire milk, see figure 12. For view of Holstein or Dutch milk, see figure 13, in which the globules are small and remarkably even in size, a striking peculiarity in the milk of the Dutch cow. The butter from this breed of cows has specific qualities ; it is neither high flavored nor high colored, but is of good quality and remarkable for its long keeping. The milk of this breed is well stored with fat, and is the richest in cheesy matter of any I have examined.

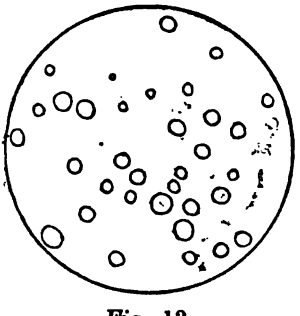


Fig. 13.

The milk of Shorthorn cows somewhat resembles that of the Dutch, but the globules are larger and not so uniform in size or quality. The milk of individual cows and of particular strains, varies more in color and flavor.

The common stock of the country being derived from the different breeds which have from time to time been imported, by crossing and mixing in every conceivable way, develop in their milk the widest differences. There is no more uniformity in the quality of their milk than there is in the certainty with which individual characteristics are transmitted.

In crossing, there is generally something of the form of the ancestors impressed on the offspring, but the characteristics of milk are less likely to follow. The milk of grades is therefore liable to great uncertainty, but it is more uniform than in the common stock. The effects of cross-breeding upon the quality of milk is sometimes very strange. I have seen the characteristics of the milk of two distinct thorough breeds so completely wiped out by crossing, that none of the peculiarities of either could be recognized.

Every variation in the constitutions of cows varies the quality of their milk, making it a matter of prime importance for every dairy farmer to know all he possibly can in regard to the laws of hereditary descent.

SPRING MEETING OF THE PENNSYLVANIA DAIRYMEN'S ASSOCIATION, HELD AT UNION CITY, APRIL 12TH.

The meeting was called to order at 2 P. M.

President Fuller in the chair.

Awaiting the arrival of speakers by the next train, a discussion was had on the policy of skimming night's milk in cheese-making.

H. C. Greene was called upon to open the subject, but declined to enter into the discussion further than to say that while he had always been in favor of full skimming, taking off all the cream possible, and making butter the staple, but turning the skimmed milk to the best advantage possible, yet he believed the present and prospective state of the market for dairy products to be such, that, except in very rare cases, half skimming would prove, as it has proved, detrimental, and a losing practice.

The butter thus made, when the cans are skimmed at the dairy, and butter is either made at the dairy or the cream taken to the factory and there churned, is not usually any improvement over common dairy butter, which is bad enough.

It is, at best, but a secondary consideration, and receives only secondary attention and care, is often poorly manufactured, and will not command a high price, though it will always bring its full value, and generally more than its value, because many people suppose that it possesses excellencies which, in fact, it does not possess.

The proceeds from the butter are not, as a rule, sufficient to offset the damage to quality, and loss in quantity in the cheese.

The cheese are rendered short lived and unsafe for transportation in hot weather, and undesirable goods to handle. They are, therefore, neglected by buyers, who prefer to put their money into a safer quality of goods.

Mr. Taylor strongly favored skimming the night's milk, which he styled quarter skimming, and had found it to pay best. He patronized the Edinboro' factory. Their cheese sells as well as if made of full cream. He doubted whether his friend Terry could even detect such cheese when well made. In short, he had little sympathy with the efforts of dealers and factory men to discourage making skim cheese. He knew the cream was lost if not made into butter, as it could not be incorporated into the cheese, but would work off in the whey.

Mr. Hall could speak from actual tests and say that if any man runs any considerable amount of cream into his whey tank, it is proof that he does not understand his business.

A gentleman enquired how the cream is to be held in the curd.

Mr. Hall—Our process is not only to gently agitate the milk while coagulation is taking place, but also to repeatedly gather the cream that rises rapidly to the surface, into one corner of the vat with a straight edge and pass it through a cloth strainer back in the vat, and thus continue to do till the mass begins to thicken. We are thus able to incorporate the cream very completely into the curd, and never have any show of waste in our whey vat.

President Fuller would take a business view of the matter. Legitimate business requires the manufacture of the first class goods only.

A few parties may make money dishonestly by manufacturing shoddy goods, as among our woolen manufactures, but their business is short lived and hazardous, while those who place upon the markets only first class goods find ready sales even in the dullest times.

While in isolated cases skim cheese may pay well, what would be the result if the great mass of the products were of that class?

It is safe to presume that while there is never an excess of finest cheese made, all reasonable demands for skim cheese will be met by those in Ohio and elsewhere who prefer to make a poor article rather than a first class one.

A 3 o'clock the regular programme was opened by a brief address by the president, A. M. Fuller.

OPENING REMARKS OF THE PRESIDENT.

GENTLEMEN:—By invitation of the dairymen of Erie county, we are met to-day for the first time in the history of the association beyond the limits of Crawford county. We desire to congratulate the dairymen of Erie county on the progress they have already made in the dairy business, and to assure them of our hearty good will, and desire to assist and co-operate with them in the attainment here of that success and proficiency in the dairy business which has marked its progress in the other and older dairy districts of this section.

Further, in explanation: Upon the suggestion of representatives from Erie and adjoining counties, the name of the association was changed, that it might not be considered in any respect sectional, but extend its benefits and assistance to the entire section, which, though it may be composed of different counties, nevertheless is only known to the trade as North-western Pennsylvania. The advantages presented in a thorough co-operation of the several counties of this section, are obvious. There is but one county in Central New York that maintains successfully a distinctive reputation, viz: Herkimer county, and she does so only from the fact that she is the parent and pioneer of the cheese interest in this country,

and possessed of peculiar advantages in point of soil and climate, calculated to develop the finest product, together with the advantages of a long experience in the business, a constantly increasing production, and a location easily accessible to the leading markets.

Owing to the extensive production of dairy products at the present time, throughout the length and breadth of the land, there would be required with us an excellent product, large production, and the lapse of many years to establish for us, either in Erie or Crawford county, a distinctive county reputation. Hence it would seem best, our interests being identical, that we endeavor to unite our forces, so far as we may be able, for the purpose of advancing the interests of the dairy business in this section—as a section.

The advantages to be derived from an interchange of sentiment and thought, must result in our attaining a higher standing in the business, and perhaps, what is far more important, a uniformity of product throughout the entire section, which will eventually secure for North-western Pennsylvania an unsurpassed reputation as a dairy district, and cause our goods to be sought after, as the most desirable in the market. We have been accused in Crawford county of a desire to monopolize the cheese interest of this section, for the exclusive benefit of our own county. We trust this brief explanation will suffice to disabuse your minds of any such impression. In the first place, it is not practicable. The older and stronger portion of the section must necessarily lead, but our experience has taught us that co-operation is necessary to success, and the more thoroughly we can become united, the greater will be the future success of this important agricultural interest.

One word in regard to the Pennsylvania Dairymen's Association. We do not wish to indulge in self-praise, but believe we can refer with pardonable pride to the success that has attended our efforts during the year that is past. We believe there is no association in the country that has received more extended or favorable mention. This in itself is little, compared with the indirect benefit which must result, in its giving to us a more extended reputation as a dairy section. Hence, let us neglect no means nor spare any effort which will tend to secure to us a more substantial and enduring reputation.

The Executive Committee of the Association, have, through our Representative at Harrisburg, the Hon. S. J. Logan, secured a desirable and valuable recognition upon the part of the State. It is due to Mr. Logan to say that he has been untiring in his efforts in our behalf, the result of which I have the honor of presenting to you. Your committee applied to the Legislature for assistance in the publication of our annual report for the year 1876, either separately or in connection with the State Agricul-

tural Report. An act authorizing it to be published in connection with the State report was passed March 15, 1876.

In closing, we desire to refer briefly to the work there is before us, and express the hope that members will remember the forthcoming report, and not only render the secretary such assistance as he may deem necessary, but endeavor to make our meeting as interesting and instructive as possible. The meeting to-day will consist of short introductory addresses on the various topics presented, and members are requested to make the discussions which may follow the important feature of the meeting.

A model Herkimer county cheese sent by E. J. Burrell, from Little Falls, was cut and freely inspected, and about two hundred pieces of the same distributed among the audience.

Considerable interest was excited, and an earnest inquiry made as to the cause of the peculiar appearance of this cheese, it being close and firm in the centre while near the surface it was interspersed with large cavities half an inch or more in diameter.

H. C. Green ventered the opinion that while the cheese was well made, it had been improperly cured, having been in its early stages overheated, thus generating a gas near the surface, causing it to rise and take on a "round shouldered" appearance, and also establishing in it a certain distinct and unpleasant acrid, biting flavor, which left an unfavorable impression on the tongue.

This opinion was concurred in by Mr. Bigger and Mr. Farrington.

It was regarded as unfortunate, that while the sample was designed as a specimen of perfection, these faults should have escaped the notice of Mr. Burrell.

The main purpose was however served, for at the centre the texture was perfect, and the manufacture, color, form and general features apparent, accompanied as it was, by a statement from Mr. Burrell that in these respects it was a perfect model of cheese designed for the London market.

Mr. M. H. Terry spoke on the

INFLUENCE OF A BOARD OF TRADE.

He spoke of the advantages buyers had heretofore held over salesmen in being able to make prices for themselves, previous to the existence of the Board at Meadville last season, contrasting those times when buyers were posted and salesmen were not, with the season of 1875, when every salesman who was a member of the Board, was just as fully posted as the buyers could be.

So far as these Boards of Trade have been established, they have met with such favor with factorymen and dairymen, that they have become a permanent institution, and although as a buyer he felt them to be no ad-

vantage to him, yet he must say in candor, that he expected the time soon to come when all the cheese and butter in the country would be sold under their rules.

If there be advantage in a Board of Trade, the greater its patronage by factories, the greater its benefits, because it will secure greater attendance of buyers and sharper competition among them. You are well aware that many of the eastern factories have by means of this competition, been enabled to obtain, at times, far more than their product was actually worth in New York.

I. R. Hall had been able to perceive a great advantage from the operation of the Board of Trade. He could see that when the salesman knows the value of his goods, he has a great advantage over one who sells by guess, as on the old plan.

Mr. T. C. Cochran had saved to his patrons $100 on one sale by making a visit to the board before selling.

Mr. Farrington said that the Board of Trade is for the dairymen, and not for the buyer, and yet as an honest man, he was free to say that he believed this was soon to be the sole method of conducting cheese sales.

The President stated that Mr. L. C. Magaw, President of the Board of Trade, had requested him to announce a meeting at Meadville on the 26th inst., to reorganize the board and prepare for the opening of the coming season.

He urged the importance of the institution, and invited the co-operation of Erie county factories and their attendance at the meeting for reorganization.

The meeting was then addressed by Mr. J. M. Bigger.

In answer to questions, Mr. Bigger stated that curd mills were in very common use in the eastern factories in case of faulty curds, and that while he believed them beneficial for general use, they were of special value in the treatment of sour and tainted curds.

Mr. Farrington gave his method of handling tainted milk and curds. He deprecated the use of such milk or its products as human food, classing it with tainted meats or diseased meats, but as his patrons will not permit it to be cast to the swine, where it belongs, he would do the best he could to save it.

He would not cool such milk to as low a point as good milk, but would encourage the formation of acid, would introduce into the curd as much sour whey as his conscience would allow and then add a liberal allowance of vinegar thus encouraging the development of acid, which would in a great measare counteract the effect of taint and at least keep the cheese in good shape and secure generally a fair appearance and flavor.

Mr. Gerow—What is the effect of covering the can up too closely over night.

Mr. Farrington—The result would be the same as to over-drive or overheat your cows. It would taint it strongly and greatly damage the product.

A paper was then read by D. W. Titus on "The Cheese Exhibit at the Centennial," which was followed by a paper by Sophus Sorensen, chemist, who treated upon the subject of milk testing from a scientific stand point.

This paper elicited some rather severe criticisms by S. A. Farrington, and a short period of rather warm debate followed, causing considerable merriment but eliciting no important facts.

The afternoon session was attended by between two and three hundred dairymen, and the discussions were sustained with much ability and interest.

EVENING SESSION.

Opened by an address by H. C. Greene.

At the close of this address attention was turned toward curing rooms and the necessity of so improving them as to secure proper curing of cheese.

The President inquired whether there were any present who had taken special pains with curing rooms and with what result.

Mr. Porter had ceiled his room and filled in the space with saw dust seven inches thick, and finds it about all that could be desired.

Mr. Farrington regarded this as a very important topic, and urged greater care in the construction of curing rooms. The result of proper regulation of the curing process is to render the cheese longer lived and better flavored, a condition greatly to be desired everywhere, and especially in this section.

The best Cheddar cheese made in England is not designed to be fit for use till from four to six months old, while our cheese is at its prime in 30 days and then rapidly goes downward in quality and price.

S. E. Kincaid, followed with a brief paper on "Butter making," in which he touched upon the principal points essential to success in the business—naming first the adaption of the farm and cows to the production of good butter and placing special stress upon cleanliness and close attention to the business as indispensable to success. He deprecated washing butter as a needless and harmful practice calculated to injure both the flavor and keeping qualities. From this position exception was taken by H. C. Green, who regarded washing as not only the easiest, but

most thorough and effective means of ridding butter from the buttermilk and the flavor of buttermilk, while it in no way whatever injures the butter.

W. E. Clark believed success depended more upon the proper treatment of the milk and cream than anything else, and that most of the poor butter is spoiled by neglect of cream. The great point to be sought after is the quality of long preservation of flavor.

The session closed with a debate between Dr. Gray and Mr. Farrington, of Cambridge, on the question of manufacturing rates.

The evening being far spent and time quite limited the disputants refrained from opening up the subject in its fullness and contented themselves mainly with references and allusions to questions of local interest merely.

Considered in all its aspects this was eminently a pleasant and successful meeting. The attendance was large and the audience evidently composed of the more enterprising and intelligent class of dairymen. The feeling was excellent and the speakers commanded the close attention of their hearers.

TESTING MILK IN CHEESE FACTORIES.

BY SOPHUS SORENSEN.

Milk is so variable a compound that the most interesting, the most important and certainly the most profitable study for the dairyman and cheesemaker is—the variation of milk.

Upon the composition of milk mainly depends the quality of the cheese, as also that which many consider even more important—the pecuniary profit. This concerns the cheesemaker. To the dairymen or producer of milk, it is no less important, since it serves him as a guide in the selection of the food best adapted for securing from his stock the milk best adapted to the uses of the cheese and butter maker, and hence the most valuable.

We know at present, practically, but one kind of cows' milk, and this we call the "whole milk;" but this term, applying as it does to all kinds of milk, if only it shall have been drawn from the udder of a cow, and not tampered with afterward—this term gives occasion for much trouble and leads to injustice. I use the word injustice as referring to cases which often occur, where some dairymen are at pains to produce only a large quantity of milk, while others are as strenuous in their efforts to produce only a good quality, while as at the present time, the former receives exactly the same price as the latter.

As regards the trouble, I refer only to the impossibility, in many cases, of deciding what is and what is not whole milk, for it is not an impossible thing, in any case, to decide if milk be simply good or not.

It is therefore an object worthy the attention of all occupied in the production of milk, or the manufacture of its products, to discover some simple, practical method by which we can ascertain the quality of milk, so that it shall receive the same consideration as we now bestow upon the quantity. At present, however, we have to do only with whole milk.

For your own protection, and to enable you to furnish intelligent testimony when, as occasionally occurs to some of you, you are called upon to testify in court as to whether whole milk has been adulterated or not, I wish to offer you such suggestions as I may be able without transgressing too far upon your valuable time.

As the Lactometer and the Cream Gauge are the instruments with which you are best acquainted, and perhaps the only ones made use of by most of those present, I shall confine my remarks chiefly to these.

In several cases contested before the court the Lactometer has been ruled out as not furnishing information admissible as evidence. Now, in many

cases, this is undoubtedly true; but cases frequently occur in which it does furnish such evidence as no intelligent or honest judge can exclude. But in this, as in most of such investigations, the result depends on whether the instrument is used intelligently and thoroughly or only superficially, and whether the point at issue is within the power of the instrument to decide. The difficulty with the Lactometer has been the effort to prove too much.

If we want to use a Lactometer, the first thing to do is to get one; and when this is done, to be sure that it is reliable and accurate. Unless a man is able to test and correct his own instrument, it is always best to pay a little more and buy instruments of precision directly from a reliable and skillful manufacturer. Not all manufacturers are reliable, nor are they all skillful, and in a majority of cases they do not care to be, or the prices they obtain for their instruments do not allow them to bestow much pains or care upon their work. Do not, therefore, buy any instruments because they are cheap. The best are always the cheapest.

I have said on a former occasion, and I repeat it here, that the scale on a Lactometer should not be marked, as is usually done, with one point designating "pure milk," and others indicating the percentage of water. It is incorrect, and will mislead the inexperienced, and involve considerable calculation even for the expert.

You all know, I suppose, that the application of the Lactometer depends on the density (that is, the weight, compared with the measure) of the milk.

Now, if the same measure or quantity of all kinds of cows' milk always weighed the same, we could easily fix and point on the Lactometer that would always answer for pure milk. But this is not the case, and therefore the best made Lactometers, with the ordinary scale, will often indicate 10 or 15 per cent. of water, or make pure milk appear to have been skimmed. The scale which the Lactometer ought to have is one showing the specific gravity, and, if it is a reliable instrument, it will show neither more nor less—and that is all you can expect a Lactometer to do.

We know that milk varies, and that its specific gravity varies accordingly; but we also know that there is a limit to these variations, and hence we conclude that if a sample of milk is lighter or heavier than the two extremes of this limit, there is something else in it. What this something else may be the Lactometer does not tell us and we use another instrument in determining this. I allude to the Cream Gauge, which measures the amount of cream. Cream being lighter than milk, it lowers the specific gravity, having the same influence as water. Hence, without this instrument, a good quality of milk, measured by the Lactometer alone, might seem inferior or watered milk.

With these two instruments all that we can ascertain is the specific gravity and the percentage of cream; but this does not inform us of the actual quality of the milk, which only an analysis of its constituents can determine.

Cream, however, is subject to even greater changes than milk, so it will be seen that the gauge is of really no great utility. If milk stands a certain length of time the greater part of the fat may be found in the cream, which varies in different milks, so that the Cream Gauge tells us only of the quantity of cream, but does not tell us the amount of fat, which i our chief concern.

When using these instruments successively, we find the cream gauge indicating a small quantity of cream, and the Lactometer indicating a small specific gravity, we conclude that the milk has been adulterated and as water is lighter than milk, and the most profitable means of adulteration, we conclude ordinarily that it has been watered; but it is evident that any other liquid may be used, provided only that it be lighter than milk.

If on the other hand the specific gravity is higher than usual, while the quantity of cream is, as before, small, we may conclude that the milk has been skimmed; skimmed milk or any other heavy liquid added, but that is all we can assume to know.

To detect the actual adulterations pre-supposes a knowledge usually possessed only by the professional chemist, whose proper work it is; so that it would be difficult to give any definite idea of the means to be employed. The non-professional should therefore lay stress, not upon endeavoring to ascertain what milk is, but upon what it is not, and it is my object to furnish you a few simple directions by means of which you may for yourselves be able to discover this.

While these two instruments may not be relied upon to afford complete evidence, they may certainly be very useful to the end of protecting interests, by furnishing indications sufficient to arouse suspicion, if the milk is not what it should be. When such suspicion is excited regarding samples of milk, all the available means should be employed and repeated in a careful manner. Take the specific gravity with the lactometer, noting the temperature of the milk by an accurate thermometer; use the cream gauge, and such evidences as the senses of smell and taste may furnish. The appearance of the whey alone may often furnish evidence of adulteration, without, however, indicating the nature of the adulterant. Besides these, another method may be made available by any one, as follows: Take a certain measured quantity of milk, and coagulate it by adding acid or rennet and heating it; filter and thoroughly dry the resulting "cheese." The weight of this may often furnish considerable light. If the process has been care-

fully attended to, so that the coagulum contains all the caseine and fat, the dry mass may be pulverized and placed in a bottle and some sulphuric ether added. Allow it to stand some time agitating it occasionally, then pour off the ether and add a fresh portion, repeating the process until a drop of the ether, after its removal from the bottle, will leave no greasy spot, or at least but a faint one, upon white paper. If this is done, and the residuum in the bottle again dried and weighed, the difference between the first and the last weights will indicate the amount of fat which was contained in the given quantity of milk. A comparison of different milks known to be pure (and taken from several different cows which have been kept under similar conditions of feed, etc., in the same neighborhood) after subjecting the samples to this same treatment, will give very valuable light on such a question.

The time will not allow me to-day to describe other processes. In the *Meadville Republican* I have discussed the matter at length in different papers on this and similar questions, and to those I beg to refer you for fuller details.

I would add: Do whatever your own experience advises you in addition, and take careful notes of the results of all you do, so that in case of need an expert may have material which will often be sufficient to enable him to base a conclusion on it, or assist him greatly.

As you have seen, I have not given you much direct information in regard to the detection of adulterations. My object has been to warn you not to place too much confidence in the Lactometer and cream gauge, and to tell you to what extent you may depend on them, and prevent your being misled by them.

When you know this, you can easily understand why these do not always furnish evidence enough to convict a man of adulterating his milk.

Now a suggestion in conclusion. Whoever has a Lacometer and cream gauge, let him use them. It does not help a man to keep his instruments on the shelf, and take them down only when he needs some evidence to prove that milk is adulterated. He may find that he is not sufficiently familiar with their use to prove anything. Use them daily, the more the better, and keep an accurate record of the results. Scanty as the information may seem to-day, it may be invaluable to-morrow.

If all the cheesemakers and dairymen would use their instruments every day, on as many samples of milk as possible, keep a record and place it at the disposal of this association, we might gain therefrom a most valuable addition to our knowledge, and by systematizing it afford a basis for some valuable conclusions.

Let every one do this, and do not pass it by for "want of time." Knowledge is power, and we can afford to pay for it, if not in money then in

time. But we all need all the knowledge we can gain. Each day brings forth new difficulties; each day offers new solutions of old problems, and as we advance in knowledge we may be able to conquer past and present difficulties, and be prepared to meet those that the future shall bring. What we actually know about agricultural pursuits at present is very little, and perhaps we know comparatively less about dairy matters, and it is to your own individual interests to contribute, so far as each may be able, to the advancement of our knowledge of these things, and although we cannot expect any very grand results, or very much information from the general use of the Lactometer or cream gauge, yet it is at least a step in the right direction—that of trying to obtain knowledge.

WHAT ARE THE CHARACTERISTICS OF THE BEST CHEESE AND HOW ARE SUCH CHEESE MADE?

BY J. M. BIGGER, CAMBRIDGE.

What is meant by the best cheese in this country is that kind that is every way suited for the foreign market, the market we are most depending upon, and commands the highest price for exporting. Such cheese, when well cured, will have a bright, smooth level surface, and as a rule, free from cracks. The rim will have what cheese makers call a velvety feeling, and when pressed by the thumb or finger will yield under the pressure like a ripe apple, springing the surface but a short distance from the pressure, and slowly resuming its shape when the pressure is withdrawn. If when pressed by the thumb the cheese appears rubbery, it is an indication that it is not full stock, is porous or not sufficiently cured. In drawing a plug from such cheese small particles should stick to the outside of the tryer, which is an indication that the cheese is rich and well cured. It should be as free from porosity as maple wood, having a similar grain, and at the same time soft and rich, mashing down readily between the thumb and finger leaving them greasy. The flavor should be mild, rich and nutty, pleasant to the taste, leaving no bad taste in the mouth after eating, and as free from bad odors as pure milk, having a flavor similar to it.

In order to make the best quality of cheese we must have a pure article of milk in a normal condition, and we are in the first place depending on the cow for that. The breed of cows kept is of little importance so long as they are good milkers, well cared for and furnished with abundance of milk producing feed and good water. She should at all times be kept in as pure an atmosphere as possible. No dead deacons or carrion should be allowed to lie around the barn or pasture and poison the atmosphere, besides being unhealthy, has a tendency to taint the milk in the udder. The milking should be done in tin pails, and the milk thoroughly aired and cooled to about 70° before sending to the factory. If the milk is delivered at the factory only once a day, the night's and morning's milk should be kept and delivered in separate cans. Everything the milk comes in contact with should be kept scrupulously clean and scalded every day with boiling hot water. The milk should be handled and kept in a pure atmosphere. The cow stable flavor often found in milk by cheese makers is fre

quently caused by the milk being handled and allowed to stand over night in the barnyard near a manure heap.

The best cheese is never made from milk that has been skimmed, and as I stated before, the milk must be pure, free from animal odor or taint, and not too old, as the process of making cheese is chemical aided by the mechanical. There can be no safe rule laid down for the cheese maker to work by except what his own experience and judgment have taught him. The age of the milk, the atmosphere, the time of the year and many other things beyond our control, all have an influence over milk in making cheese. We can only have a system which must be varied according to circumstances, and the cheese maker that makes no rule is a failure.

I will briefly notice that system. It is better to have the milk, or a portion of it, 12 hours old. Great care should be taken to mix the cream that rises on the night's milk by running it through the strainer with the morning's milk. It is a good plan in cold weather to thin the cream with warm water. After adding coloring to suit the market the cheese is intended for, set the milk with rennet, free from taint, at a temperature from 84° to 86°, stir in the rennet thoroughly, then agitate the surface to prevent the cream from rising, until you can see signs of coagulation, which should take place in from 15 to 20 minutes. In cold weather it is a good plan to cover the vat to hold the heat as much as possible. In about three-quarters of an hour or an hour the curd should be sufficiently coagulated so that when raised by the finger it will break clean; it is then ready to cut lengthwise. After standing a short time to allow the curd to still harden, cut crosswise, then let it stand until the whey and curd are separated so that the whey will be one or two inches thick on the surface. The curd by this time will be sufficiently hardened to commence heating. Work first gently with the hands lifting the curd from the bottom of the vat then cut enough to make a medium curd before applying the heat. Heat very gradually, and handle as little as possible, just enough to prevent the small particles from adhering. Occupy from one to two hours in heating, according to the condition of the milk, and raise the temperature from 96° to 98°, holding the heat until ready to dip. It is better in warm weather to draw down the whey in the early part of working. The point to dip at is very important. The hot iron test is very reliable under most circumstances. This test consists of taking a piece of curd from the vat, after squeezing all the whey out of it, apply to a hot iron—"experience will teach the temperature to have the iron"—if ready to dip, the curd will stick to the iron, and when drawn from it will spin out in fine threads to the length of one-quarter to three-quarters of an inch according to the time of year, and about as fine as No. 100 spool cotton. When the curd is in this condition the whey should be all drawn and ready to dip into a curd sink or cooler to

drain. After it is sufficiently drained salt with any good salt that is free from lumps, at the rate of 2½ to 3 pounds per thousand pounds of milk, according to dryness of curd and season. After mixing the salt thoroughly and stirring the curd until well aired and cooled put to press. After pressing 20 to 22 hours the cheese will be ready for the shelf.

Another way to make the best cheese is to Cheddar the curd. The application of heat to effect the separation of the whey from the curd was first practiced at the village of Cheddar, in Somersetshire, England, hence the name. But what we understand by Cheddarring is to handle the curd the same as in the other process until through heating, when as a rule the whey is drawn sweet, and the curd packed on each side of the bottom of the vat to mat and become one solid mass, leaving a furrow through the centre for the whey to drain. It is cut in convenient pieces and turned every 15 or 20 minutes until the acid is sufficiently developed, which can be determined by several tests. The hot iron test is not as reliable in this process as a clean acid in the whey, or another test is the appearance of the curd, it will be in layers and when pulled apart will split like wood, it is then ground in a curd mill and salted at the rate of two pounds to two and one-half pounds of salt per one thousand pounds of milk.

Some of the advantages of this process are, the whey is got rid of sooner, therefore the curd is not influenced so much by its impurities, it does not require so much salt nor attention in making, the cheese will appear richer, more apt to have perfect flavor and long keeping qualities.

Some of the disadvantages are, it is thought by some to take more milk to make a pound of cheese; consumes more time in making, and the rim is more apt to check. Every cheese factory should have a curd mill, whether they practice the Cheddar system or not, they are very necessary in working mills that is not perfect.

In conclusion, a few hints on curing cheese will not be amiss. When the cheese is first taken into a cure-room that is so constructed that the temperature of the room can be controlled, they should be allowed to dry on the surface before greasing with whey oil, and should be turned and rubbed thoroughly every day until cured, this aids in the curing and appearance. The room should be kept at a uniform temperature of about 70 degrees. The cheese is more easily injured when it first commences curing than at any other time. If they are then kept too warm fermentation will be too rapid, causing the cheese to become porous, get off in flavor, and go into early decay. If kept too cold fermentation will be checked and the cheese will sour in place of curing, and in addition to having the characteristics of a sour cheese, will become bitter, hence the importance in curing properly. It is safe to estimate that more than one-third of the cheese is spoiled in this way.

LOCAL INFLUENCES AS AFFECTING QUALITY OF DAIRY PRODUCTS.

BY H. C. GREENE.

The one thing that distinguishes the manufacture of dairy products from every other manufacture, is the variableness of the raw material. In other material there is a permanency or fixedness of character which enables the workman to make in advance somewhat definite calculations as to the results that will follow a given course of treatment, and to determine in advance the treatment required to produce a given grade or quality of product.

The cheesemaker, however, can do nothing of the kind save in an approximate degree.

The science of cheesemaking has not yet advanced to the point that affords him the means of determining with the desirable degree of definiteness the quality, character and condition of the material he has in hand.

To-day the weather being cool, with the atmosphere pure and wholesome, the milk is found in good condition, the formula of the cheesemaker works perfectly, and he says, "If I could be assured of such milk as this every day, I would not hesitate to guarantee the quality of my cheese. Give me always such milk and I'll never quit the business.

Twenty-four hours, or perhaps less, brings a change of weather, it becomes damp, sultry and hot, and the milk changes correspondingly to a tainted or sour condition, or perhaps both.

The poor cheesemaker sweats and worries over tainted curds, that when he has done his best for them, are still scarcely better than ruined, and in his chagrin and disgust he vehemently declares his entire willingness to quit the business at once.

No other class of workmen take a deeper interest or a greater personal pride in the workmanship of their hands than cheesemakers, and this interest is greatly stimulated by the facts under consideration.

Where a rigid adherence to theories and rules, however correct in the main, must result in serious loss during a considerable portion of the season, the mind is kept constantly on the alert, and the energies are taxed to the utmost, to modify processes and introduce new expedients, to meet the recurring changes in condition and attain to something like uniformity of product.

Thus the calling is one of more than usual exhaustion of nervous force. The operator scarcely gets relief from this severe nervous tension during the active season.

His nights bring him no complete rest, for his overwrought brain is ever seeking to devise new expedients for meeting the opposing forces that conspire with such silent subtle power to thwart his best matured plans and overturn his carefully studied theories.

Thus we see that the work of the cheesemaker is in no proper sense mechanical in its nature, but it is in the highest sense scientific, involving the exercise of ever ready, yet ever variable skill and tact, a skill that is never able to lead the workman quite up to his ideal.

From all these considerations we rightly conclude that very much that is said and written about cheesemaking, and buttermaking too, is vain speculation, having no solid foundation in facts, while a multitude of theories, true and reliable in thousands of cases, are utterly untrustworthy in other thousands of cases.

As an illustration we see a very successful Herkimer county cheesemaker, but a rather airy philosopher, coming before the American Dairymen's Convention to announce the discovery of a new idea that the pressure of a great volume of whey tends to force, or squeeze the whey from the particles of curd at the bottom of the vat, and cause it to cook or mature faster than that nearer the surface. From this he argued that very deep vats were better than shallow ones for cooking curds and that a better cheese can be made from a full vat than from a vat only half or a third full.

Now we do not believe either his obversations or his conclusions for we remember that a mass of liquid presses equally upon all sides of any solid that may be immersed in it. He seemed to forget that the bottom of the curd is almost always warmest and that this would account for the curd curing faster.

The peculiar characteristic of milk to which I have referred, namely its variableness of quality and condition is due to a multitude of causes, only a small proportion of which in all probability have been observed and recognized.

Change of weather, of feed, altered conditions of health, feverish conditions of the system even not indicating disease are among the recognized causes that affect the quality of the milk, and there is nobody to question the fact that quality of milk more than skill of manufacture determines the quality of the product.

We have the word of all general dealers in dairy products that every locality has its distinct characteristic of quality.

The difference in richness, texture and flavor between Ohio and Herkimer, New York, cheese is as great as the difference in the conformation of the two sections.

Orange, Delaware, Bradford and Chester counties are each noted for their excellent butter products, yet the product of no two sections is alike.

Now, the difference cannot by any means be accounted for by the difference in skill or methods employed in the various sections, though this is a matter of great importance.

Those of us who have had experience in different sections, have found that success in one section is not at all a guarantee of success in another section. In the spring of 1875, there came into Crawford county two men of mature years and large experience in cheesemaking, one from Cortland county, where he had sustained a reputation as a first-class cheese maker; the other was from the old Fairfield factory in Herkimer county, a factory of world-wide repute.

Both were unsuccessful in their new fields. They put their cheese up in fine shape and style, but the essential elements of excellence were wanting.

That of the one was porous and wanting in body as well as flavor, while that of the other was solid, rather tough, cured slowly, and when cured developed a sharp, acrid, unpleasant flavor, such as every buyer chooses to pass by in silence. These were the characters of the first two months' product, but by persistent effort and experiment each finally became master of his situation to a tolerable extent, though neither was satisfied with the result of his own efforts. These are only samples of cases that are constantly occuring among us where the want of success can only be attributed to the fact that the milk in this section requires different treatment from that of central New York. On the other hand, whenever a cheese maker from Ohio comes among us he invariably turns out a cheese having all the objectionable features of the mass of Ohio cheese, soft, honey-combed and sweetish, short-lived and undesirable goods to handle. This fact shows us that in natural facilities our section is more nearly like Ohio than like the eastern dairy sections and that we have these evils to overcome; and how shall we overcome them, except by studying the nature and chemistry of milk so that we may determine for ourselves wherein the difference exists and be able to supply what is needed.

I believe the time will come when no person will be regarded competent to manufacture cheese unless he can analyze milk and separate it into its component elements; till he shall make the chemistry of milk, cheese and butter a special study, and thus be enabled to obtain an intelligent understanding of the character of his material.

Now, if these things exist as facts, is there not a lesson to be drawn from them important to be learned?

We are in a comparatively new dairy field, between and in a close proximity to two older fields, the one of which has a reputation chiefly for badness, while the other has won a better name. We find in the contour of

these sections a sufficient cause for great difference in quality of pasturage and water, and in these two we see reasons for vast difference of quality and condition of milk.

Added to these natural influences we find much in the habits and predisposition of the people tending in the same direction.

The products of Ohio have for years to a great extent found their way to Pittsburg and Cincinnati, near by markets, having only a home trade and the habit of making soft flat cheese is there almost universal, such cheese as sells very well in near by markets when new, but will not bear transportation in hot weather, and when the local markets get overstocked and this cheese goes to the English shippers as a last resort, it goes at a fearful discount.

For this reason Ohio cheesemakers and producers are decidedly unfriendly to the New York market.

Ohio has methods of her own that were successful in the past years, but have passed out of date and favor, while Chautauqua and Cattaraugas have copied more from methods further east, and seek, and rely only, or chiefly, on the eastern markets.

They, therefore, are compelled to study the whims and caprices of New Yorkers, and of Englishmen as well.

Experience has taught us that we can find a profit only in studying the eastern markets and meeting their demands. On which hand, then, shall we look for our models.

For we must have a model, we must have an ideal to which we aspire, and which is above our present standard.

It is a matter of much importance that we choose our model wisely, one that we may possibly equal, and that when we do equal it will insure us better prices, and a reputation of which we may be justly proud.

Herkimer county gives us such a model. We have it before us, and although we may not observe that marked difference that we have expected to find, we must remember that a slight difference in the quality of fine cheese makes great odds in favor of the best. And also that expert tasters are able to perceive excellencies, and detect faults that escape the sense of the unpracticed.

The reputation of Herkimer county cheese is not all in the name, it has resulted by a happy combination of natural facilities with long and persistent efforts to improve, these efforts having been all along stimulated to the utmost by sharp competition among dealers who have been diligent students of the market demands, and experts in judging qualities.

The true policy for our factories is to secure the supervision of skillful persons, and, as far as possible, to avoid changing superintendents, and thereby changing the character of your products.

Give your superintendent opportunity, and insist upon his using it, to make frequent visits to neighboring factories, not to instruct and boast of his own success, but to be instructed by observing the methods and practices of others, as well as to examine for himself their products and observe the results.

Thus will you go on, approximating nearer and nearer to the best models until you shall make for yourselves a reputation and a name that shall not only permit, but demand, the branding of your cheese with the true local brand.

While there undoubtedly exist such climatic and soil differences, differences in pasture grasses and in water, as shall forever give to each locality its own characteristics, yet by skill and long practice these may be in a great measure overcome, so far, at least, as that we may be enabled to obtain satisfactory results.

It must be borne in mind, however, that the cheese is not made when it is taken from the hoop and set upon the shelves.

The essential process of cheesemaking goes on not in the vat room, but in the curing room.

When the cheese is formed, it is not in any true sense cheese. It is cheese only in form, not in character. And yet it should contain all the needed elements of cheese.

The chemical action and combination of these elements by the application of heat, is the true cheese making process.

Right here is where the great mistake, the almost universal mistake is made, in supposing that the skill of the manufacturer ends with the forming of the curd into shape.

The great mass of cheese factories are constructed on this supposition, and no adequate provision is made for the regulation of the temperature of the curing room.

In hot weather the cheese is broiled till the oil oozes out at every pore, and when there comes a storm and the subsequent change of temperature, they feel its full force, and are held, perhaps, for several days at such temperature that the needed fermentation is checked, and the ultimate flavor is seriously impaired.

This is a subject worthy of more serious consideration by our people. Without doubt a large portion of our early and late, and nearly all of our hot weather cheese might be enhanced in value at least a cent a pound by the proper regulation of the curing process.

Very few factories last fall but suffered severely from this source, even in their September cheese.

In this changeful climate we cannot hope to attain the perfection till factories are provided with curing rooms that can be made practically independent of the weather.

THE "PERCENTAGE" PLAN IN CHEESE MANUFACTURING.

To Factorymen and Patrons:—At the recent convention of the Pennsylvania State Dairymen's Association, the subject of the "price for manufacturing" was briefly presented in the annual address, and elicited some discussion on the part of the Association. This in connection with other matters of importance, was referred to a committee, who reported in favor of adopting the percentage plan, and recommended it as a policy likely to prove the most satisfactory, and secure justice to both patron and factoryman.

I have been called upon to explain this plan fully and explicitly for the benefit of the interest, and will present a brief statement explaining its merits and demerits.

In order that you may fully comprehend the subject, we quote from the annual address that part relating to

THE PRICE FOR MANUFACTURING.

"The discussion of this subject at the present time, may be looked upon by some as premature, but we believe there is nothing to be gained by beating around the bush, and that we can present an argument upon this point that will explain, though it may not prove acceptable to the majority, the spirit in which this matter should be met. Many patrons argue that the factorymen are receiving too great a compensation for their investment and labor. It was thought by the inexperienced a few years since, that it was only necessary to invest a few thousand dollars in a factory, put the milk in one end and dollars would run out of the other. We believe a majority of the factorymen find this to be an exploded theory, and that actual experience has rather proved the reverse to be true. Patrons should consider that an investment of this kind is constantly depreciating in value, and demanding frequent additional expenditures in the way of repairs, while the patrons' returns though seemingly small in comparison, are rendered far more desirable when we take into consideration the indirect benefit they receive in the increased productiveness and value of their farms. Again, when you refer to other sections as a precedent, the fact must not be overlooked that owing to their long experience in the business, they have adopted that management in the receiving of milk at the factories, which entails little expense on the part of the manufacturer, while our factorymen at the present time pay fully twenty per cent. to their patrons for the delivery of milk; also, that factories

manufacturing at a low rate are generally supported by a large patronage. What factorymen would not prefer to manufacture the milk of 600 cows at $1 50 per hundred, rather than the milk of 300 cows at $2 00 per hundred? And further, by allowing the factoryman a fair compensation for his investment and labor, you enable him to employ the most experienced help, and provide the best materials needed in manufacturing, hence we would say to patrons do not adopt that course which will result in the production of an inferior quality of goods, but allow the manufacturer a fair return for his labor and investment."

The percentage plan we believe to be not only the simplest form, but a plan which secures justice and equity to both patron and factoryman, and proves the easiest method for insuring a correct dividend. The rate which we believe to be the most equitable for the interest at the present time is one-sixth.

In explanation—Suppose a factory sells or consigns cheese, and receives a net return of 12 cents per pound, the manufacturer receives one-sixth, or $2 per hundred. Suppose it nets 10 cents per pound, he receives one-sixth or $1 66⅔ per hundred, if sold at 9 cents, $1 50 per hundred. If the price exceed 12 cents, he receives proportionately more, but no matter what the price, one-sixth of the gross proceeds.

In declaring a dividend, suppose you sell 5,000 pounds of cheese at 12 cents, equivalent to $600, the manufacturer receives one-sixth, or $100, which is $2 per hundred for manufrcturing.

Now, the question arises, wherein consists the advantage of this plan? We will presume at the outset, that neither factoryman nor patron desires more than simple justice in the matter. The reason why patrons argue that the manufacturer should receive a less price than formerly is because, owing to the low price of cheese during the past year, he feels that he is assuming all the burden, and the factoryman no risk.

In adoption of this plan, the factoryman being an interested party, it becomes him to endeavor, not only to produce the best article he can, but to secure the best price for it, his return being based upon the price obtained. It also secures to the patron, in event the factoryman obtains $2 00 per hundred, $1 00 per hundred for his milk, for the cheese must sell for 12 cents in order to guarantee this.

In regard to one matter, however, I cannot retract any argument advanced in the annual address relating to this subject. We must not overlook the fact, that the majority of the factories are weak, and the few strong. The factory receiving the milk of 600 cows can manufacture at a less price, and realize more profit than the factory with a light patronage manufacturing at a higher rate. We do not believe that any factory hav-

ing a patronage representing less than 300 cows should manufacture for less than $2 per hundred, but as the weaker party is always more or less at the mercy of the stronger, this is a matter which each factory must solve to its own satisfaction.

In all estimates which we have made, the factorymen is supposed to furnish all necessary supplies, the patron being only responsible for the delivery of the cheese at the station.

Trusting this explanation will prove satisfactory, and tend to adjust the difficulties that may and are arising between factorymen and their patrons, and hoping for a continuance of the good will and harmony which has marked the progress of the dairy interest in this section, I remain,

Respectfully, &c.,

A. M. FULLER,

President P. S. D. A.

MEADVILLE, *January* 12, 1876.

MANUFACTURERS AND PATRONS.

BY H. G. GREEN.
In *Meadville Republican*.

The subject of the communication in another column by Mr. Fuller, is at present and will be for a time of paramount interest to both patrons and factorymen.

It is not our purpose to become a partisan in the contest that has arisen in some localities, and bids fair to become quite general, wherein patrons demand lowest rates of manufacturers and the latter are loth to submit to the extent of reduction demanded.

We do not propose to become the champion of either party as against the other, but as has been our practice to cut straight through between extremes to the mean, which will be for the abiding interest of all. Since our connection with this department of *The Republican*, as before, it has been our constant aim *to work for the greatest good of the dairy interest.* And in all that has dropped from our tongue or pen, the spirit of partisanship has been conscientiously rebuked, and what has been written, has been with a view to planting the dairy business of this section on a sure and permanent basis, as far as newspaper writing can be influential towards such a result.

We have criticised at times the faulty practice of both classes as we thought they ought to be criticised, always careful not to array either class against the other. The ignorance, the stupidity, the heedlessness, the filthiness and faithlessness of some patrons and their unjust exactions upon cheesemakers and salesmen have been shown up in their true colors.

While on the other hand certain pernicious practices on the part of cheesemakers and factory proprietors have not been spared. Among these may be mentioned the once a day practice of receiving milk without requiring proper care of the night's milk at the dairy, the skimming of the can and manufacture of poor butter from such cream—the practice of fraudulent weights of milk to insure larger apparent yield of cheese—to win patronage by a false impression, the selling of 105 or 110 pounds of cheese for 100, "by private arrangement" to gain the credit of being a shrewd salesman and getting a higher price than any other salesmen, and defrauding enough in milk weights to keep up the show of a fine yield. And what is more pernicious than all other evils, and is probably more than any other, the occasion of the present attitude of patrons towards factorymen, and fruitful of all other evils connected with the system—namely, the heartless

and cruel contentions of factorymen among themselves. Each striving to drown his neighbor or at least to swallow his business and starve him out, even at the risk of choking himself in the attempt, these and other sharp and dull practices at once impolitic and dishonorable have received merited rebuke at our hands.

How great or how small has been the influence of our counsels and criticisms is not for us to say. Certain it is that some of these evils have fastened themselves upon the body of the factory system, and it struggles with a dead weight which hinders its progress, and seriously threatens its prosperity, if not its life. The manufacture of cheese is not at an average in any section a lucrative business. The risks are great, and if a factory is not valuable for factory purposes, it is no value whatever. Its only security is in a fair patronage, for without patronage it becomes worthless. This is one great reason why the manufacturer should be "wise as a serpent," and at the same time "harmless as a dove." But instead, it has been too common for him to take his little ax of innuendo, or, perhaps, more open detraction, and hew away at his neighbor's patronage, with a view to crippling him so as to close his business out prematurely. And this cutting and slashing has extended from patronage to character, reputation and credit. All have been haggled and mutilated by this merciless and murderous practice.

The direct and legitimate effect has been, as we have often said, to convey the impression among patrons that there are great profits in manufacturing and furnishing at present rates.

However false the statement may be—and I positively know it to be false in the cases of very many of our factories—yet there is a large class of unreasoning men who persist in believing it, and for this state of things factorymen have only to thank themselves.

With a reasonable amount of cordiality of feeling, with a reasonable appreciation of the legitimate fruits of *illegitimate competition* and due forecasting to obviate them, factorymen would have found no serious difficulty in satisfying the reasonable demands of patrons, that henceforth both parties should alike share in the advantages and disadvantages of fluctuating prices and dull markets.

We have for some months foreseen that this question of rates must be met before the opening of the season of 1876, and have suggested that steps be taken toward harmony of action among factories, not to oppress patrons, but to inspire greater confidence among them, for without such confidence there can be no stability to the business.

The first and wisest thing to do is to work for the mutual interests of each other.

If factories can not live without patrons, neither can patrons prosper without factories. Each is necessary to the interest of the other, and whatever and whoever works to array these parties against each other, works to undermine the factory system and destroy it, and with it the entire dairy interest in this section, and should be looked upon and treated by both parties as a common enemy, not to be tolerated by either.

If manufacturers defame each other or over reach the bounds of possible profit in their efforts to draw from each others patronage, to break up hauling routes, what else can be expected than that patrons will be jealous and suspicious of them, and eagerly inquire, "How is it that you can afford to persist in giving away your regular profit to certain patrons? Does it not show that either your manufacturing rates are too high, or that by some means unknown to us you make your apparent loss good at our expense?"

These are natural questions and factorymen who have done these things must now answer them. But the worst feature of the case is that the innocent must suffer the same penalty as the guilty, and share in the odium that attaches to such practices.

There is, however, a ground of equity, upon which the parties may and should meet. There is a point below which a manufacturer cannot run his business. There is a point of fair compensation for risks incurred and labor performed. We advise all parties to be fair enough and candid enough to strive to find that point of mutual interest, and, if possible, to meet there, shake hands and set out on the Centennial year on a better basis and with kindlier feeling than ever before. We believe that a just and equitable arrangement can be more easily secured by the adoption of the percentage plan than by any other, and that after trial, both parties will be pleased with it.

We believe also, that if in any locality a serious rupture occurs attended with unjust demands and a failure to compromise, it will be under the leadership of unprincipled partisans who ought to exert no influence over intelligent and honest men.

We believe that by each party seeking to act fairly and render a just equivalent for advantages gained, consulting the welfare of others and cultivating a mutual feeling of good will, the interests of all will be best subserved and a higher degree of prosperity attained than ever heretofore.

Therefore, we counsel a peaceful and honorable and permanent settlement of the questions at issue.

REPORT

OF THE

PENNSYLVANIA FRUIT GROWERS' SOCIETY.

PREPARED BY ITS OFFICERS.

1876.

CONSTITUTION.

ARTICLE 1. This association shall be entitled "*The Pennsylvania Fruit Growers' Society,*" and its objects shall be the advancement of the science of pomology and the art of fruit culture generally.

ARTICLE 2. Any person may become a member of this society by a vote of the majority of the members present at any meeting and by paying into the treasury the sum of one dollar annually; or the payment of one dollar to the treasurer at any time shall constitute membership and entitle said member to a copy of the proceedings. The payment of ten dollars at one time will constitute life membership.

ARTICLE 3. Its officers shall consist of a President, three Vice presidents, a Recording and Corresponding Secretary and a Treasurer, all of whom shall be elected annually by ballot.

ARTICLE 4. The following standing committees shall be appointed: A Committee of five on Nomenclature; a Committee of three on Insects, of whom the Professor of Entomology shall be chairman; an Executive Committee, consisting of the President, Recording Secretary and Treasurer; and a general Fruit Committee, consisting of one member from each county represented, with a general chairman of the whole; each member of the Local Fruit Committee to have the privilege of appointing two assistants.

ARTICLE 5. The society may at any time elect honorary members.

ARTICLE 6. The society may from time to time appoint Professors on Entomology, Botany, Horticultural Chemistry and Geology.

ARTICLE 7. This constitution may be altered or amended by a vote of two-thirds of the members present at any regular meeting, notice of the proposed amendment, in writing, having been previously given.

ARTICLE 8. Seven members shall constitute a quorum for the transaction of business.

BY-LAWS.

ARTICTE 1. The Committee on Nomenclature shall collate and decide the standard and synonymous names of all fruits known in the society, with the authorities for each, and report, so far as practicable, at each regular meeting, and record the same in a book kept for that purpose.

ARTICLE 2. The General Fruit Committee shall carefully and thoroughly investigate the subject of fruit culture in general. Each local committee of three shall collect such useful and interesting information in relation to the subject as may be in their power, and embody the same in monthly reports, to be made to the general chairman; such reports to be by him examined and embodied in his annual or semi-annual reports. Also, that the said county committees shall form *ad interim* committees for their respective counties; and further, that said *ad interim* committees are hereby authorized to publish their reports in the "*Gardeners' Monthly*," or such other paper as they may select, the same having been first submitted to the chairman of the General Fruit Committee for his approval: *Provided*, That said publication shall be free of expense to the society.

ARTICLE 3. The annual meeting of the society shall be held on the third Wednesday of January of each year, at such place as the Executive Committee may appoint, at which time the election for officers shall take place; said officers to serve from the close of the meeting at which they are elected to the close of the succeeding annual meeting, at which time an exhibition and discussion of fruits shall take place, and other business transacted in the following order:

1st. Reading of minutes of previous meeting.
2d. Roll called and dues collected.
3d. Election of officers.
4th. Reports of officers.
5th. Reports of standing committees.
6th. Reports of special committees.
7th. Unfinished business of former meeting
8th. New business.

The nomination and election of new members shall be in order at any time during the session.

ARTICLE 4. Other meetings may be convened by the Executive Committee at such time and place as they may appoint.

ARTICLE 5. No member who is in arrears for dues shall be eligible for any office, or serve on any standing committee; and any member who shall neglect to pay his dues shall cease to enjoy the privileges of membership.

LIST OF OFFICERS FOR 1876.

PRESIDENT.

EDWIN SATTERTHWAITE, Jenkintown, Pa.

VICE PRESIDENTS.

S. W. NOBLE, Jenkintown.

H. M. ENGLE, Marietta.

TOBIAS MARTIN, Mercersburg.

RECORDING SECRETARY.

E. B. ENGLE, Marietta.

CORRESPONDING SECRETARY.

WM. P. BRINTON, Christiana.

TREASURER.

G. B. THOMAS, West Chester.

LIFE MEMBERS.

Bartram, J. Hibberd, Milltown, Chester co.
Brinton, W. P., Christiana, Lancaster co.
Bissell, W. S., 1901 Spring Garden street, Philadelphia.
Calder, Rev. Jas., Agricultural College, Centre co.
Cornelius, Robert, Philadelphia.
Ellis, B. Morris, Hughesville, Lycoming co.
Engle, J. G., Marietta, Lancaster co.
Engle, H. M., Marietta, Lancaster co.
Garrettson, Joel V., Flora Dale, Adams co.
Hayes, Charles P., Philadelphia.
Heyser, Jacob, Chambersburg, Franklin co.
Hildrup, W. T., Harrisburg, Dauphin co.
Hoopes, Josiah, West Chester, Chester co.
Hiller, Casper, Conestoga, Lancaster co.
Hiller, Peter C., Conestoga, Lancaster co.
Hacker, Wm., Philadelphia.
Landis, Israel, Conestoga, Lancaster co.
Martin, J. O., Mercersburg, Franklin co.
Pannebaker, Wm. M., Lewistown, Mifflin co.
Reist, Peter L., Lancaster co.
Shaffner, Jacob, Wheatland, Dauphin co.

HONORARY MEMBERS.

Downing, Chas., Newburg, N. Y.
Meehan, Thomas, Germantown, Pa.
Michener, Dr. E., Tough Kenamon, Chester co., Pa.
Parry, Wm., Cinnaminson, N. J.
Rathvon, Prof. S. S., Lancaster.
Rowe, Hon. D. Watson, Chambersburg.
Saunders, William, Washington, D. C.
Stauffer, Jacob S., Mount Joy, Lancaster co., Pa.
Thomas, John J., Union Springs, N. Y.
Warder, Dr. John A., Cincinnati, Ohio.
Willets, Rev. Dr., Philadelphia.

ANNUAL MEMBERS.

Achelis, George, West Chester.
Anders, Joseph K., North Wales, Pa.
Applebaugh, R. T., M'Veytown.
Bernheisel, Sol'n, Green Park, Perry co.
Bombaugh, Aaron, Harrisburg.
Brinton, S. L., West Chester.
Brinton, Moses, Octoraro, Pa.
Burkholder, Jno., Bendersville, Adams co.
Boas, A. T., Reading.
Brindle, A. C., Mechanicsburg.
Brandt, Dr. E. B., Mechanicsburg.
Benjamin, H. D., Reading.
Blessing, Paul, Jr., Coatesville.
Biddle, T. C., Chadd's Ford, Del. co.
Burton, John, Germantown, Pa.
Conard, A. F., West Grove.
Cook, Jesse M., 214 Walnut st., Philad'a.
Cook, M. S., Avondale, Chester co.
Cooper, Calvin, Bird-in-Hand, Pa.
Cummings, R. M., Montandon.
Cocklin, E. H., Shepherdstown, Cumberland county.
Cocklin, Jacob, Shepherdstown, Cumberland county.
Carter, John I., West Grove.
Christmas, Isaac F., Stonersville, Berks co.
Darlington, Henry T., Doylestown, Pa.
Davis, E. M., Phila., 333 Walnut st.
Dykeman, G. R., Shippensburg.
Eby, J. R., Harrisburg.
Evans, E. J., York.
Erb, John B., Lampeter, Lancaster co.
Engle, E. B., Marietta.
Engle, Daniel G., Marietta, Pa.
Frantz, M. A., Harrisburg.
Fisler, 1. E., box 214, Harrisburg.
Frazer, Isaac, Mechanicsburg.
Garber, J. B., Columbia.
Geddes, Samuel, Philadelphia.
Gross, D. M., Harrisburg.
Garrigues, Thomas, Kingsessing.
Guthrie, W. D., Chambersburg.
Grover, Leverett, Windsor, Ohio.
Haines, R. B., Cheltenham, Montgomery county.
Haines, John S., Germantown.
Hamilton, A. Boyd, Harrisburg.
Harrison, A. W., Philadelphia.
Harvey, Thos. M., West Grove.
Heiges, S. B., York.
Heiges, J. M., York.
Herr, Cyrus N., Strasburg.
Hiester, Chas. E., Harrisburg.
Hill, Dr. Geo., Hughesville.
Hoopes, Abner, West Chester.
High, Ezra, Reading.
Hunewell, J. T., M'Veytown.
Irvin, James, Ickesburg, Perry co.
Kauffman, A. J., Columbia.
Kiner, A. N., Shippensburg.
Kinsel, M. F., M'Veytown.
Kauffman, Levi, 400 Walnut st., Phila.
Landis, B. L., Landis Valley, Lancaster county.
Landis, Israel D., Lancaster.
Lewis, Joseph, Jr., Newtown Square, Delaware county.
Leh, J. H., Allentown, Pa.
Lingle, John L., Harrisburg.
Linn, John, Chambersburg.
Lauer, Frederick, Reading.
Landis, Dr. Henry, Reading.
Longsdorf, H. A., Mechanicsburg, Cumberland county.
Lint, Peter, York.
Martin, Tobias, Mercersburg.
Merceron, F. F., Catawissa.
Mitchell, J. E., Philadelphia.
M'Millan, C. C., Gettysburg.
Mumma, Hon. D., Harrisburg.
Murdoch, John, Sr., Pittsburg.
Miller, D. N., Harrisburg.
Miller, Chas. H., Mt. Airy, Philadelphia.
Noble, S. W., Jenkintown.
Nissley, C. B., Mechanicsburg.
Neff, J., Dallastown, York county.

Parker, J. T., Mercersburg.
Pyle, J. W., Willow Dale.
Purman, Wm. J., Tallahasse, Florida.
Purple, S. H., Columbia.
Pownall, Levi, Christiana.
Potts, W. C., Lewisberry, York county.
Reed, Wm. G., Chambersburg.
Reynolds, S. H., Lancaster.
Rufe, Morgan, Doylestown, Pa.
Roberts, Rowland, Horsham, Pa.
Rupp, H. S., Shiremanstown, Cumberland co.
Rhoads, Dr. R. B., Douglassville, Berks county.
Rush, John A., M'Veytown.
Satterthwaite, E., Jenkintown.
Schæffer, W. L., Girard National Bank, Philadelphia.
Sharp, S. W., Newville, Cumberland co.
Shoch, Samuel, Columbia.
Small, G. H., Harrisburg.
Smith, W. H., Syracuse, N. Y.
Snively, John K., Jackson Hall, Franklin county.
Snyder, David, Bath, Northampton co.
Small, Samuel, York.
Sprout, A. R., Picture Rocks, Pa.
Stouffer, John, Chambersburg.
Suesserott, Dr. J. L., Chambersburg.
Smith, F. L., Reading.
Sheetz, J. A., Womelsdorf, Berks co.
Stitzel, Geo. D., Reading.
Sheller, Alf. S., Lewisburg.
Saxton, J. O., Mechanicsburg.
Shelly, Daniel, Shiremanstown.
Stevenson, S. L., Clark's Green.
Shoemaker, R. C., Jarrettstown, Montgomery county.
Thomas, G. B., West Chester.
Thomas, R. H., Mechanicsburg.
Underwood, Alex., Mechanicsburg.
Weiser, B. H., York.
Williams, J. S., New Hope, Pa.
Wilson, G. W., Bendersville, Adams co.
Woods, T. A., Sixth and Boas sts., Harrisburg, Pa.
Young, John S. B., Reading.
Young, Wm., Reading.

PENNSYLVANIA FRUIT GROWERS' SOCIETY.

The seventeenth annual meeting of the Pennsylvania Fruit Growers' Society was convened in Lenape Hall, Doylestown, Pa., on Wednesday afternoon, January 19, 1876. The weather was unfavorable and the attendance during the afternoon and evening was small. There was a variety of fine fruit on exhibition, chiefly apples, prominent among which was "Smith's Cider," the favorite and leading variety in this section of the State.

The Society was called to order by President Satterthwaite, of Jenkintown, Pa. Minutes of last annual meeting were read by the Secretary, and approved. Mr H. S. Darlington, in the name and in behalf of the local societies and clubs, cordially welcomed the society to Doylestown, and to the use of the Hall free of charge. The President responded in behalf of the Society, thanking the citizens of Doylestown and Bucks county for the kind manner in which they were received. Stated further that the Society came as learners, and that the object in holding meetings in different parts of the State was to acquire knowledge from the practical experience of the people.

Calling of the roll was dispensed with. Collection of dues and election of officers were postponed to subsequent sessions. The Treasurer, Mr. Robt. Otto, being absent, Mr. Pannebaker, of Lewistown, was appointed Treasurer *pro tem.* The following is the Treasurer's statement for the year ending July 1st, 1875:

Statement of the Treasurer of the Fruit Growers' Society of Pennsylvania, up to July 1, 1875.

Balance on hand from last report	$173 87	
Received fees of life members	70 00	
Received fees of annual members	67 00	
		$310 87

EXPENDITURES.

Cash paid as follows:

1875.

January 20. Paid E. B. Engle, as per bill	$3 68	
20. Paid E. B. Engle, Secretary's services	25 00	
20. Paid S. B. Heiges, as per bill	16 45	

January 20.	Paid S. B. Heiges, current expenses	$ 50	
25.	W. P. Brinton, as per bill	3 05	
25.	For stamps, used by Treasurer	81	
			$49 49
	Balance on hand		$261 38

ROBERT OTTO, *Treasurer.*

WEST CHESTER, *July* 1, 1875.

Report of the General Fruit committee was presented and read by the chairman:

MR. PRESIDENT:—The task assigned me is rather a difficult one, as you doubtless have experienced while performing the same duties. To make a full and reliable report for our entire State, while so many counties are not represented in the Society, is out of the question.

To give you a report such as this Society is entitled to, for the counties from which reports have been received, is an arduous task. The conflicting reports from the local committees make it impossible, unless by giving you each individual communication, or a synopsis thereof. I sent out about forty circulars into nearly as many counties, with stamped and addressed envelopes for return. About half of these were returned, and some of them were quite brief. All, however, have my hearty thanks. Some of them are quite full, and contain much valuable information. I propose to read a few before this Society, as they refer to subjects which should receive our consideration before our final adjournment. These with a number of others I would suggest be placed in the hands of the publication committee as an available source of matter for our next annual report.

The apple crop for 1875 was quite short throughout the State, and the fruit of inferior quality. There is a general concurrence of opinion in the sub-reports on this point. The principal cause of this failure is attributed to the codling moth. It seems evident that the less bloom and set of fruit, the larger is the proportion destroyed by these enemies. This, however, may be only apparent, for when there is more fruit set than can be matured, insects often come to the rescue, and may under the circumstances be beneficial, but the result is an increased brood for the season following. The concurrent testimony is that very little is being done toward destroying or staying the ravages of insects generally. With this indifference on the part of fruit growers, and the general destruction of insectivorous birds, the prospects for regular fruit crops are not at all flattering.

The general failures are attributed to other causes by some of the committee. J. B. Garber, the veteran pomologist of Lancaster county, holds that the periodical extreme cold winters have been the prime cause of

general failures of tree fruits. H. S. Rupp, of the Cumberland valley, is of the same opinion. Casper Hiller, of Lancaster county, holds that the failure of the apple crop of 1875 was caused more by unfavorable weather early in the season than by insect ravages.

In some sections the apple tree borer is sufficiently destructive to injure the vitality of trees, causing decline and premature decay, while in other localities the tent caterpillar has made great havoc.

Amid all these adverse reports, there are few localities that have not one or several varieties of apples that bear fair crops of fine fruit, either annually or bi ennially. These exceptions prove that either the proper means are not known, or not applied to secure a more regular supply of this important fruit. Reports of regular and reliable bearers almost invariably refer to seedlings, or kinds very little known outside of their native localities.

The pear crop was fair to good, with few exceptions, although the list is about as large as that of apples. The plantings are generally confined to a few leading varieties, consequently there is not that wide difference of opinion in pears as there is in apples. Were it not for blight, to which the tree is so subject, we should encourage much more extensive planting. As it is, it may be safe to urge the planting of a larger proportion of this excellent fruit, especially as blight is also becoming quite prevalent among apple trees.

The peach seems to rise in importance with each succeeding year. Although success in its fruiting is confined to narrower limits than most other fruits, in its season it is more in demand and more extensively consumed than any other. The great surplus in the east, the past season may have discouraged planting in that section for the present, but it will only stimulate more extensive planting elsewhere. I will here reiterate what I have heretofore advanced; that there are many localities in the southern tier of counties in this State, where the peach can be grown with as much certainty, and to as great perfection as in Delaware and eastern Maryland; and were the business as well managed as it is in the latter sections, the western and northern portions of our State could be supplied with peaches of equal quality and in better condition than from the aforenamed States.

In some of the interior counties of this State, peach growing has been a success when judiciously managed. The "Borer" and "Yellows" are everywhere the chief obstacles to successful peach culture. How to prevent them has often been discussed, but thus far without suggesting any infallible remedies. As the plantings advance northward a more judicious selection of soil, locality, variety and after-management are essential to success. The introduction of new varieties, both early and late, has con-

siderably prolonged the peach season over that of former years. The continued introduction of new varieties will probably prolong the season beyond our present anticipations, hence, the increased importance of this crop.

The plum, so desirable and popular, continues to be confronted almost everywhere by its old enemy the curculio. It is however encouraging to learn that like "oases in the desert," there are reports from localities where this fruit is successfully grown, from Cove Valley, Blair county, which borders on the eastern slope of the Allegheny ridge, we have very flattering reports of plum culture. In fact there has been sufficient success to induce more extensive planting, and the demand for trees has of late been far in excess of former years. The German Prune is quite a favorite in this valley, but nearly all the choicest varieties are successfully grown. The reports generally give discouraging accounts throughout the State. The Richland seems to be one of, if not the most reliable kind on the list, except, perhaps, some of the coarser varieties for which the "Little Turk" may have no relish.

Cherries the past season were below an average crop, especially the finer varieties. Mazzards flourish almost spontaneously on all light, slate and gravelly soils, and probably facilitate the breeding of curculio more than all other fruits combined. Thousands of bushels of this fruit are thus worse than wasted every year. If only the trees of the better kinds of Mazzard were permitted to grow, and their fruit picked in proper season, it would not only check the spreading of curculio, but with the present facilities for pitting and drying, it could be converted into a marketable article for which there is always ready sale at paying prices. The only redeeming feature in this slipshod method of growing Mazzards is, it attracts fruit-eating birds from the improved kinds, but even this is small compensation for the general loss of the plum crop, caused by such curculio nurseries. The cultivation of the improved kinds of cherries is entirely too much neglected, and their value as a market crop much underrated.

GRAPES.

Reports on this fruit are quite meagre, compared with the importance of the crop. We do not hesitate to assert that there is no fruit grown in this State that will produce from a given area a crop of equal weight, of such quality and value, with so much certainty as the grape. When properly trained so that the vines can be laid down and protected, there can be no excuse for having it winter killed, and no reason why a bountiful crop should not be the result. The Concord continues thus far to bear the title of "The Grape for the Million," as we hear of few failures where any other

variety will succeed. On the contrary it is in many cases reported a success where no other kinds give the desired results.

The Martha has proved equally hardy and nearly as productive but is objectionable to many on account of its sweetness. At the same time these two varieties have been fruited side by side in Lancaster county to probably as great perfection as is possible in vineyard culture, and shipped together to Philadelphia markets, where the latter sold invariably 40 to 50 per cent. higher than the former.

The presumption is that Philadelphians have as keen a taste for, and are as good judges of grapes as the rest of mankind.

There are, however, many new and rising candidates for the highest honors on the grape list, some of which may ere long supersede the above. The successful hybridization, by Rogers, Arnold, Wylie, Ricketts and others prove that varieties can and possibly will be multiplied to an extent far beyond our present anticipations. In such case our native grapes may yet vie with those of any other country. The standard varieties most largely planted comprise Concord, Martha, Ives, Telegraph, Hartford, Clinton, Delaware, Iona, Rogers' Hybrids, Eumelan and a few others. Isabella and Catawba are generally reported as discarded, yet in some localities they continue to be leading varieties, especially along the lakes and islands. Thrip and phylloxera are the principal insect enemies. Mildew is also found in most localities, and is, perhaps, in many cases as injurious to the vine and fruit as insects.

BLACKBERRIES.

This fruit is reported considerably neglected in consequence of the abundance of wild berries. Near large towns and cities, however, they are extensively cultivated, and make up a fair proportion of the small fruit trade. The Lawton, formerly so popular, has been superseded by Kittatinny, which is more hardy and gives more general satisfaction. Wilson's Early, although somewhat earlier, is being pretty generally discarded, being of inferior quality and less reliable. An enemy has become prevalent in Lancaster county, which threatens to seriously interfere with its cultivation. We have no reports of its appearance in other localities. It is known here only in its larvæ state in the shape of a white grub about an inch long, averaging in thickness about the size of a goose quill. It penetrates through the heart of the roots, and partially into the stem at the collar. Some plantings have failed to produce crops for several years, which was at first attributed to other causes. Our entomologist has now some of the grubs in charge, and will report on the insect as soon as it matures.

RASPBERRIES.

Except in the vicinity of cities, this fruit is very little cultivated. With the same care bestowed upon it that is usually given to other fruits, it will repay bountifully, the Black Caps being as hardy as Oaks, and some of the Reds, nearly so. The addition of new and improved varieties has effected a new stimulus in the interest of this fruit. The Herstine, although not quite satisfactory everywhere, is no doubt the most popular raspberry in the State.

The strawberry is the most popular and most extensively grown of our small fruits. Many varieties have had their day of popularity and have long since been placed upon the "retired list." After all the adverse criticisms to which Wilson's Albany has been subjected, it is to-day more generally planted and cultivated than any other half dozen varieties put together. It has thus far continued to hold the position among strawberries that the Concord holds among grapes and the Bartlett among pears. A variety that would supersede the Wilson has been forthcoming for a number of years; but as yet has not reached us. It is desirable that we should have a berry of equal productiveness and less acidity. We hope the public will soon be gratified with the long looked for berry. "Charles Downing" is quite an acquisition but does not quite fill the bill. Many good words are spoken for "Col. Cheyney;" "Springdale" and "Cumberland" stand on their dignity and might be the coming berries. The drouth about the time of ripening reduced the crop of last summer much below what it promised earlier in the season.

Currants and gooseberries, unless when somewhat shaded or properly mulched, are seldom a remunerative crop. The currant worm which is destructive almost everywhere has very much discouraged planting.

The summing up of failures and successes, although somewhat laborious, is less difficult than to trace their causes, as it is so common for observers to arrive at different conclusions while making observations from the same standpoint. It is therefore important that the general fruit committee organize a more thorough and efficient system of reporting, to carry into effect the plan originally laid down when the society was organized. In connection with the full reporting of crops we should know the nature and condition of the different soils, their different inclinations and altitudes, temperature and rainfalls, the state of the weather and conditions of the atmosphere, whether humid or dry, at the different stages of crops, and the management of trees from planting until fruiting.

Entomology has become so intimately connected with horticulture that every committee-man should closely observe and report the habits of insects in his locality. The various funguses which affect crops should be also described and reported.

In conclusion, having in view the important work of this committee and the reputation of this society, it is very desirable and important, on the threshold of this Centennial year, that not a single county in the State should be left unrepresented. I would therefore suggest that the Corresponding Secretary be requested at once to procure the names and addresses of one or more active Horticulturists in every county not represented, and forward them to the Chairman of General Fruit Committee for 1876. Having extended this report beyond what was intended, it is hereby, with its shortcomings and imperfections, respectfully submitted.

H. M. ENGLE,
Chairman General Fruit Committee.

After concluding the reading of his report, Mr. Engle invited any remarks or criticisms that it might suggest; hoped the members would be free to discuss the various subjects treated therein.

Mr. Meehan stated in reference to strawberries, that wilson's Albany has failed considerably in the vicinity of Philadelphia during the past two years. The variety which will supersede it is not yet decided; Charles Downing seems most likely to take its place.

The question of reducing the fee of annual membership was considered by the society; H. M. Engle stated the annual fee originally was only one dollar. It was, several years ago doubled in order to raise sufficient funds to print our annual reports and meet other necessary expenses. During the past two or three years the annual reports have been printed at the expense of the State, and our expenses considerably reduced in consequence. He thought an annual fee of one dollar ample, and made a motion that it be reduced to that amount, which was adopted.

The consideration of "unfinished business," gave rise to brief discussion and explanation. For the benefit of those not present at the last annual meeting, Mr. Meehan stated that it has been proposed to change the name of "The Pennsylvania Fruit Growers' Society" to that of "The General Horticultural Society of Pennsylvania." There is now in the State a "Pennsylvania Horticultural Society," highly honored and of excellent reputation but rather local in its work and influence. The objects sought in a change of name are a larger field of usefulness and a greater range of topics for discussion by the introduction of subjects pertaining to general and ornamental gardening. While a general desire for a new name was manifest it was not thought advisable to adopt the one proposed, and the further consideration of the subject was postponed for the present.

Mr. Darlington expressed a desire to become a member of the society and thought others present would do likewise if an opportunity was presented.

Mr. Engle hoped that our friends would not hesitate to become members of the society and take part in all the discussions. Our object in meeting in different sections of the State was to gather all the information we can, and at the same time increase our membership from year to year. A short recess was then taken to give persons an opportunity of joining the society.

The following interesting and practical letters from fruit growers and members of the society who could not attend its meetings, were read by the secretary:

MEADVILLE, CRAWFORD COUNTY, PA., *January*, 13, 1876.

E. B ENGLE, ESQ., *Marietta Pa.:*

DEAR SIR:—Two weeks of invalidity unfit me to prepare "An Essay on Grape Culture," as you suggest, even were I otherwise capable of doing the subject justice. I can give you the outlines of a practice that with me works well, but I doubt if there will be found in it anything of novelty by those at your meeting.

I trim my vines in October, soon after the fruit has been gathered. Taking off nearly all the laterals and leaving only so many of the well ripened red canes of the current year, as will secure plenty of light and sunshine, and air, with the anticipated developement of the next season.

About the 1st of November all vines, in doors and out, are laid down and covered. I use staves of old nail kegs with one end sharpened, and notched in the side; in holding the vines down, they can be doubled up so that a large vine will occupy but little room.

The covering should be light colored (not black earth) the object being coolness not warmth, or in other words being to guard against a thaw in the winter time, and the premature starting of the sap in the spring.

I uncover vines under glass about the first week in April, and out of doors from the third to the last week of same month.

I thinned out the fruit last year, out of doors as well as in, and think I was the only person in this section who had any varieties fully ripe, I know of many failures, and heard of no success.

The Delaware was the only satisfactory out door grape with me, although the Isabella and Telegraph fully matured. Several varieties of Rogers & Arnold's Hybrids, and even the Concord here last season did not ripen.

Under glass my vines are washed before being laid down, with a mixture of soot and sulphur rapidly applied with a shoe brush. The vines are slung with the heads down in the spring for a few days to start the lower buds.

Sulphur is sprinkled on the borders several times in the summer and exposed to the solar heat, the fumes so produced being the antidote for mildew.

Much heat I think makes the fruit run to juice. Moderate heat and free ventilation gives the best results in healthy vines and substantial fruit, that is fruit with the proper pulp or body to it.

Whitewashing the glass does much in regulating heat. It prevents injury from excess of heat in July and August and it keeps the heat in at night by preventing radiation. It makes less water requisite and prevents the bleaching of the borders.

I find a very good material for borders, both as soil and mulch, is made of maple leaves, treated with wood ashes or some alkali to hasten decomposition. This material seems a great promoter of fibrous roots.

Though it gives some test to dabble with varieties, the kinds selected from centuries of experiment, and long established, will generally give better satisfaction than novelties often much puffed from mercenary motives. Experimenters with seedlings will find the old kinds difficult to surpass.

Hoping your meeting may be a success, to which I am sorry I cannot contribute,

I remain very truly, yours,

A. HUIDEKOPER.

CINNAMINSON, N. J., 12 13, '75.

E. B. ENGLE, *Secretary*.

RESPECTED FRIEND:—Thy favor of 6th received inviting me to furnish an essay for the Pennsylvania Fruit Growers' Society, to meet at Doylestown, on the 19th of next month, which I must respectfully decline. Our New Jersey State Horticultural Society meets at New Brunswick about the same time, and it is expected for me to be there. I think my name had better be dropped from the list of members of the Pennsylvania Fruit Growers' Society, as it is inconvenient for me to attend the meetings.

With regard to the peaches inquired after, the *Amsden* has not fruited with me yet.

The *Beatrice* is the earliest peach we have. Very productive, handsome, good quality, free from rot, and a good shipper. Will prove very valuable for early market.

Louisa is medium size, with a red cheek; melting, juicy and sweet; good for near market, but not a good shipper.

Rivers is one of our finest early peaches. Large, we had them the past summer to measure $2\frac{3}{4}$ inches in diameter or $8\frac{1}{4}$ in circumferance. Pale straw color, with a slight blush, waxy appearance, round, sweet and delicious. Good for home use or a near market, but not for shipping a great distance. Ripens with Louisa, a few days later than Beatrice.

Very respectfully,

WILLIAM PARRY.

CORNWALL ON THE HUDSON,
ORANGE CO., N. Y., *Dec.* 17, 1875.

E. B. ENGLE, ESQ.,

MY DEAR SIR:—Your kind letter of invitation found me quite seriously ill. I am now slowly recovering but with great reluctance write that I fear there are no such pleasant experiences before me this winter, such as your letter suggests. My health is such as will render great prudence essential. It would give me very great pleasure to be present on the occasion you name and to meet those whom every year I find more congenial, and with whom I have more interests in common. Fruit growing and perfecting is almost a passion with me. I think I have a new gooseberry and a new raspberry that will distance all competitors; but I do not like to talk too largely yet; though they have been well tested already, I wish them to stand still further and severer trials. Unless they are what I claim I do not wish to send them out though I could make a fortune by them.

In November's American Agriculturist you will find an engraving and description of the gooseberry, and in my circular (inclosed,) a description of my raspberry. I expect to fruit both another year to a sufficient degree to satisfy myself and others, I trust, of their value.

Gratefully appreciating the honor of the invitation from the Pennsylvania Fruit Growers' Society, conveyed by you to me, I remain

Very truly yours,

E. P. ROE.

HOOPES BRO. & THOMAS,
CHERRY HILL NURSERIES,
WEST CHESTER, PA., *Jan.* 11, 1876.

MY DEAR FRIEND SATTERTHWAIT:—For the first time in very many years it is probable I shall not be able to attend the meeting of the Fruit Growers' Society. I have been quite unwell all winter, and dislike leaving home. I have prepared a little paper for the meeting, which I enclose, for fear I shall not be on hand personally, also treasurer's report. The books, papers, &c., with the balance of money on hand I still retain, ready to hand over to the new treasurer, when appointed. The committee appointed at last meeting to collect a show of Pennsylvania fruit for the Centennial exhibition did nothing, from the fact that the Centennial Horticultural Society no longer exists.

Sincerely yours,

JOSIAH HOOPES.

RIDGEWOOD, BERGEN CO., N. J.

E. B. ENGLE,

MY DEAR SIR:—Your request at hand, and were the days long enough, and had I nothing else to do, there might be a chance of my answering the many similar calls for papers, essays, &c., for annual meetings and reports. But I am not able to meet these demands upon my time, however pleasant it would be for me to do so; hence, please excuse me for declining to deliver a short essay before your society at its next meeting.

Yours truly,

A. S. FULLER.

MOUNT AIRY NURSERIES,
5774 GERMANTOWN AVENUE.
PHILADELPHIA, *December* 18, 1875.

E. B. ENGLE, ESQ., *Secretary*,

DEAR SIR:—Yours of the 13th inst. informing me that I had been selected by the Fruit Growers' Society of Pennsylvania to write on the subject of "Herbaceous and Bedding Plants," came duly to hand. I regret exceedingly that I must decline, and ask you to substitute some other member in my place, as my time will be so occupied during the next month that I could not possibly give the subject the attention and care to write anything of interest or impart any information to your members.

I shall endeavor to attend the meeting at Doylestown, and shall be pleased to have you call on your journeying there.

Yours, very truly,

CH. P. HAYES.

INTERNATIONAL EXHIBITION, 1876.
UNITED STATES CENTENNIAL COMMISSION,
PHILADELPHIA, *January* 3, 1876.

E. B. ENGLE, ESQ.,

DEAR SIR:—In answer to your kind invitation to prepare an essay on trees and shrubs, and to be present at the next meeting of the Pomological Society to be held at Doylestown, I am sorry I cannot comply with your request; my time is fully occupied just now, so much so that I could not give the subject the proper attention.

I hope however to be present at the meeting, when I hope to meet my old friends who I hope will be there in sufficient force to make the meeting pleasant and interesting.

Yours very respectfully,

C. H. MILLER.

READING, PA., *December* 20, 1875.

MR. E. B. ENGLE, *Sec'y Penn'a Fruit Growers' Society,*

DEAR SIR:—I have just returned from Philadelphia, where I have been for some days, hence the delay in acknowledging your favor of 13th. I regret exceedingly that owing to a great number of engagements, I am utterly unable to avail myself of your kind invitation, had you written a few weeks sooner I might probably have done so, but as it is, I doubt if I will be able even to satisfactorily get through what I have promised, the more so as the nights are all that I have for my scientific work, secular labors requires all my day hours. Trusting at some future time to be able to respond to your kind invitation, believe me with best wishes,

Very respectfully yours,

HERMAN STRECKER,

Box 111 *Reading P. O., Pa.*

E. B. ENGLE,

Thank you for invitation and circular. I should like to look in on you were it not so far away. Merry Christmas.

W. C. FLAGG.

MORO, ILL., *December* 28.

MEADVILLE, PA., *December* 6, 1875.

E. B. ENGLE,

DEAR SIR:—Please accept thanks for your cordial invitation to Pennsylvania Fruit Growers' Convention, at Doylestown, on 19th proximo. I shall be with you in spirit, but fear my plans for the winter will not admit of personal presence.

Hoping your convention may be a success,

I remain truly yours,

A. HUIDEKOPER.

In reference to Mr. Parry's request to have his name stricken from the list of members of this society; Mr. Meehan stated, that although not a a resident of this State, Mr. Parry had always taken a great interest in the welfare of the society and usually attended its meetings and took a prominent part in its deliberations. In view therefore, of his valuable services, and his position as one of our leading fruit growers and horticulturists he moved that his name be placed on the roll as an honorary member of this society which was unanimously agreed to

Mr. Huidekoper's letter, giving his experience and success in grape culture was well received by the society.

Mr. Meehan thought very well of Mr. Huidekoper's suggestions and spoke of his good success in grape culture. Mulched by setting boards edgeways on grape borders and filling with leaves sometimes to the thickness of nearly a foot. The roots are thus enabled to feed near the surface without being exposed to drouth.

The president considered Mr. Huidekoper's plan an excellent one; there is nothing to be compared with leaves to keep out frost; they are the best protection for celery he has ever used.

Mr. Sprout, (Lycoming county,) considered the letter and remarks very interesting. Had practised the same principle with decided success; one year ago he used crushed stalks of sorghum as a mulch and the result was the heaviest crop he had ever raised. Strawberries treated with leaves in a similar manner, also succeeded better than any he had ever grown.

Mr. Darlington asked for further reports concerning the new early peaches spoken of in Mr. Parry's letter.

Mr. Magill, (Bucks county,) has E. Beatrice planted but not fruiting. In reference to mulching grapes, has used grass cut from his lawn, with excellent effect.

Mr. Engle, chairman general fruit committee, suggested that a few sub-reports from members of the committee be read by the secretary. Those of J. B. Garber of Lancaster county and Dr. Suesserott of Franklin county were accordingly read and briefly discussed. Mr. Garber's report was not favorable, peaches, plums and cherries having been injured by severe cold. Old apple trees have died from its effects and young ones very much injured. Pears have fruited five years in six, peaches three years in five, and plums have failed entirely owing to the ravages of the curculio. Of grapes most of the new kinds have done pretty well though some are ruined by mildew. The report from Franklin county was more encouraging. Soil and climate being very favorable to successful fruit culture; more attention is being paid to that branch of horticulture. The culture of flowers is also increasing in that vicinity.

In discussing the report of Mr. Garber, there was a disposition to question his theory as to the cause of failure among apple trees. Mr. Sprout stated that in Lycoming county peach trees have suffered in that manner, and related the case of an orchard on the south side of a hill from which he never had a bushel of peaches. The wood did not ripen, was full of sap, and consequently was injured by cold. On a northern exposure he had better success.

Mr. Engle thought Mr. Garber's theory was not rightly understood, and would try to explain. Mr. G. probably did not claim that the trees were frozen outright, but that their vitality was weakened to such an extent that they have never recovered. His own experience is that it is not always

the greatest degree of cold that injures fruit trees. Sudden changes of temperature are more destructive to vegetable life than severe and long continued cold. In his vicinity peach trees will bear 6 to 8 degrees below zero without injury, while in Michigan they will bear more.

Mr. Pannebaker stated that white or hoar frosts injure trees and destroy the fruit. Three years a white frost destroyed every bud on his trees except on high ground where no frost was seen. Has noticed that with the thermometer showing the same degree of cold, one year with a white frost the fruit was injured, while the other year it escaped.

Mr. Satterthwaite (President.) There are many circumstances aside from the degree of cold that will injure trees. Soil, location, variety and manner of culture all have their influence. Have known peaches to survive 12 degrees below zero.

The subject was further discussed by Messrs. Meehan, Sprout, Engle, Pannebaker and the President, and brought forth many conflicting opinions as to the effect of frost and cold upon fruit trees.

Adjourned to 7 o'clock P. M.

EVENING SESSION.

Society was re-convened at the appointed time, when the President read his annual address.

Gentlemen of the Pennsylvania Fruit Growers' Society:

I do not find that the constitution or by-laws of this society impose upon the president the duty of delivering a formal address at these meetings, but under the peculiar circumstances in which I assume the duties of the chair, a few words would seem to be proper. Had I been present at your last meeting when I was appointed to this position, I should have most emphatically objected on the ground of total ignorance of the duties pertaining to the position; but when, after the meeting had adjourned, and it was then too late to make another appointment, I was informed of what had been done, I did not see any help for it but to accept, and I so notified the secretary, and as this is the first opportunity I have had to do so, I now return my thanks for the distinguished honor, for I assure you I consider it an honor to be chosen to preside over such an intelligent body. So far as pertains to the duties of presiding over your deliberations at these meetings, I have had no misgivings, as I know that the uniform courtesy which always prevails in a body like this, brought together for so unselfish a purpose, can make the duties of presiding officer no other than pleasant; but there are, of course, other and various duties pertaining to the office of president of this society, and of these I must plead almost total ignorance; but I trust that whatever loss has occurred to the society from the inefficiency of the president has

THE BRIGHTON GRAPE

Blank

been in great measure compensated by the efficiency and zeal with which your secretary has attended to his duties and looked after the interests of the society. The programme which has been prepared and published as a basis for the discussions at this time, it was thought, would afford opportunity to bring up almost any and every subject which could be desired connected with fruit culture, as well as other branches of horticulture, which also now comes within our province to discuss. It is true that most, if not all of these subjects have been treated of before at these meetings and some of them repeatedly, but none of them have been exhausted, for there is no branch of horticulture but in which new facts are constantly being brought to light and new fruits of every kind are continually claiming our attention. It was also thought that as we meet this year in an entirely new place, and amongst an intelligent and wide-awake people, interested in this as in every other branch of useful knowledge, it would be well to lay out a pretty wide field of inquiry, so as to give opportunity to every one to solicit and give information upon such subjects as they may be interested in; and here, perhaps, it would be as well for me to say, what it is proper I should say, to those who have favored us with their attendance here, who are not members of our society, that they are cordially invited to take part in the discussions and contribute such information as they can—that any questions they may wish to ask in connection with the subject under consideration will be cheerfully answered, so far as we are able to answer it; and we wish it to be distinctly understood, that there is no member of this society, no matter how long or how devotedly he has given his attention to the subject, but who knows that he is himself but a beginner and that there is always something to be learned from the observations of even the most inexperienced; all that we ask is, what every one will at once see the propriety of, that in these discussions gentlemen will be concise and confine their remarks to the subject immediately under consideration. Of course, it will not be expected that all of the subjects selected for investigation will be exhaustively treated during the few short sessions to which we are limited, what was contemplated was, that each subject should be taken up in order and such points commented on as the members or persons present may feel interested in, and thus opportunity will be given to bring out everything new in connection with each subject, and to answer all enquiries concerning it. If this plan of proceeding is approved of, I will endeavor to facilitate its satisfactory consummation by giving a full opportunity to every one to say what they know, and to ask for what they wish to know, without taking up more time than the importance of the subject may justify, and in this way I think we shall be able to go over a great deal of ground, without letting anything escape notice that should claim our attention.

It has been usual, and no doubt perfectly proper, at these annual meetings for the President in his address to give his views at length upon such subjects connected with our science, as seemed to him to be interesting or important. But as I did not set out with the intention of preparing a regular formal address, I do not propose to give my views here upon any of the many interesting questions which might be treated of; but prefer to say what I have to say upon them, when they come up for discussion before the meeting in their order; when I will be found willing to tell what I know. It has also been customary for the President in his annual address to lay before the meeting a general statement of the fruit products of the past year; but as I think this is properly the duty of the fruit committee, who have much better opportunity and who will doubtless perform this duty satisfactorily, I will confine myself to some very general remarks on the condition and prospects of fruit-growing as a business. To those of us who are interested in growing fruit to sell, there is one thing sufficiently obvious, that fruit products of every kind, have been for a number of years constantly on the increase; at least if we may judge by the state of the markets, which are constantly overstocked. This is undoubtedly largely owing to the increased facilities for transportation, which have grown up within a few years, bringing the remotest parts of the country within reach of our markets and into close competition with those of us, who once considered our location near the great markets of the country, an advantage that could not be overcome. But steam power has worked great changes in a few years, not only are our markets now glutted with fruits from the most distant parts of our own country, but all the rest of the world is made to contribute to this superabundance. The constant, rapid and cheap transportation of products, which is now going on in all parts of the world, as well as instant communication by telegraph, has brought us into close competition, not only with the more favored climate of our own Pacific coast in the far west, but also with the sunny climes and cheap labor of the more distant east, Spain, France, Italy and the still more remote shores of the Mediterranean are now constantly pouring into our markets their exhaustless crops of oranges, grapes, figs and an infinite variety of other luscious fruits. I do not mention this as a thing to be complained of, but only that as it is a matter that directly, and most seriously affects our business and our pockets, it is something that we may not ignore. It will never do to say that the wonderful achievements of science and skill, of industry and enterprise can be otherwise than beneficial, but when the question is, to plant, or not to plant, the consideration of these questions is undoubtedly of the greatest importance. There is one thing which it seems to me cannot admit of a doubt, that fruit of all kinds must always be cheap and no one need plant with any other expectation. The day for fancy prices for fruits has gone, never to return.

These remarks are not made in any spirit of despondency, for I do not for a moment suppose but that fruit growing will always continue to be a fairly remunerative business when intelligently pursued, but in order to do this, it is necessary to understand the whole situation, and know what we have to contend with. If our peach growers had been more wise, and had considered all the circumstances connected with their business as fully as they ought to have done, they would not now be lamenting the most disheartening of all failures, a crop totally unremunerative from its excessive abundance. It might almost seem from what has been said, that it was useless to try to improve in the art of fruit growing, since a great deal more is now produced than there is demand for. On the contrary, I think that the competition which is lessening the value of the crop makes it all the more necessary to sharpen our wits and increase our knowledge of the business by all possible means. There is no other chance for success.

In taking a broad and general view of the situation, it must be admitted that the prospects of fruit growing as a business is not as encouraging as it might be, partly for reasons that have been mentioned; rapid and cheap communication with all the world has brought us in close competition with the more favorable soils and climates, and the cheap labor of distant lands in all parts of the world. This, perhaps, is no more than other branches of productive industry are suffering from the same cause. But this does not better the situation. At the same time it must be obvious to every one that the depression that has been spoken of in the business of fruit growing, is not caused entirely by the influences that have been alluded, but is largely owing to the general stagnation in business, the blighting effects of which are ruining every business enterprise. It would, of course, be out of place here to enter largely into this subject, but as a convention of business men met to consult together upon all questions affecting our interests, as a class, it may be wise to take a glance at the whole situation. When the question of planting or not planting is to be considered, it is all important to understand whether the condition of things from which our business, in common with all others is suffering, is likely to be lasting or only temporary. I must confess for one, that though the cause is apparent enough, I can see no likelihood of any effectual remedy being applied.

The fearful mountain of foreign debt which for several years we have been piling up againt us, the continual increase of this load by the excess of our imports over our exports, the paying of interest by adding to the principal and to this must be added the enormous sums annually taken out of the country by fashionable pleasure seekers traveling abroad; (this single item is supposed to be not less than one hundred millions of dollars the past year, more of itself than all the real money in the country;) these

causes combined have created an incubus of debt, that no nation in the world could live under and prosper. For myself, I see no practical remedy; the only ones possible are to produce at home most of the products which we are now buying of other countries, and persuade our people to stay at home and help to develop their own country instead of taking all the money out of the country to spend foolishly abroad. The first of these cannot be adopted because the facilities of transportation have now practically brought all the world to our doors, and nothing can stop the influx of the cheap products of the cheap labor of other countries, but a nominal reduction of the price of skilled labor here, and that is what no man living will ever have the courage to advocate. And as long as the demands of fashion make it indispensable to travel, this fearful drain on our resources can never be stopped.

I trust that this much can be said upon a question that directly affects our interests and business prospects, without exciting a suspicion of political motives or prejudice; nothing could be further from my mind; my own opinion is, that no political party or no act of government can reach the root of the evil. I have given this hasty glance as the future business prospects, because it seemed indispensible in making up a summary of the situation, which I think it would be always wise to do on these occasions; we all know, some of us have good reason to know, that there is now more fruit produced and sent to market than can be disposed of at remunerative prices. For the successful prosecution of our business it is all important to know whether this arises entirely from excessive production, or partially, perhaps largely, from the general stagnation in business, which has reduced the ability to purchase in the mass of consumers. My own opinion is, that there is not now, nor is not likely to be an excess produced, if the business enterprise of the country was prospering as it should be; but from what I have said it may be inferred that I do not think this likely to be the case very soon. Of course it will be seen that the foregoing remarks are intended only for those, who, like myself, make fruit growing a business; to that other large class, who grow fruits only for consumption in their families and for the pleasure of the pursuit, they have no application. So far from saying anything to discourage this class of fruit growers, I feel that I cannot say enough to encourage them. I should consider myself the greatest of public benefactors, if I could persuade all my countrymen to think as I do myself, that every man in the United States should possess a country home and grow all the fruits that his family could consume.

As I before stated, my intention was to make only a very few general remarks here, reserving my opinions upon the various interesting subjects connected with the science of fruit culture, until those subjects

are regularly introduced for discussion. There is, however, one idea that it has occurred to me to mention before closing these remarks. I have long noticed, and particularly during the last few years, that have been remarkable for extremes of all kinds of weather, that all kinds of fruits are affected to a greater or less extent by the peculiarities of the season. Many varieties, for instance, that are generally good for nothing, are now and then extremely fine; and others again that are generally good, are once in a great while very poor. I have observed this every year, particularly with different varieties of apples and pears; having many varieties of these fruits under cultivation, I have noticed how some, which, perhaps, never before were of any account, will be for one year extremely fine, others will perhaps be good for two or three years and then become worthless again, and this very often cannot be accounted for by any peculiarities in the season that is perceptible. I mention this not only because it is a very curious and remarkable fact in itself, but as a very important consideration in judging the value of varieties of fruit. I believe that very many mistakes are made by too hasty conclusions in judging of the value of a variety by the observation of perhaps one or two exceptional crops. There is no question connected with fruit culture of greater practical importance than the selection of the most valuable varieties to plant, and there is certainly no question that needs to be decided with more care and caution. I think I have known many serious mistakes to arise from the disposition of enthusiastic fruit growers to rush into print to extol the merits of a variety of fruit which they have happened to notice doing remarkably well, and which perhaps, never before, or never afterwards was of any account.

I could not feel that I had discharged my whole duty at this time, without calling your attention to the approaching Centennial celebration. It has been frequently urged that this society had important duties to perform in connection with the great exposition about to be inaugurated, and committees have been appointed, I believe at different times to attend to this matter but with what particular object in view I cannot explain, nor can I learn that this society has ever been invited to participate in any way in the exhibition, I have consequently no suggestion to make, but earnestly desire that such action may be taken as will show our willingness to perform our whole duty, if there should be any to perform in promoting its success. It is, of course, very desirable that Pennsylvania should make a creditable pomological display, and I have no doubt that if proper efforts are made she need be behind no other State in this department, and everything which this society can do to promote this object, I hope will be done, and any suggestions that may be made with this object in view, I am sure will receive your earnest consideration.

Mr. Meehan agreed with the President that some effort should be made for a creditable display of Pennsylvania fruits at the Centennial, but did not see how anything could be done by the Society, as a body. The American Pomological society, at its last meeting, concluded that they could do nothing in the way of exhibiting fruits as a society. They would, however, meet in Philadelphia during the Centennial Exhibition, and make a display. Suggested that this Society could co-operate by meeting at the same time and arranging for a general exhibit of the fruit growing resources of this State.

The following, on "The Interests of the Society at the Centennial," was written by Prof. S. B. Heiges, of York, and being applicable to the subject under discussion, was read by the secretary:

THE INTERESTS OF THE SOCIETY AT THE CENTENNIAL.

One of the main objects in changing the name of the society at the York meeting was in order to become more comprehensive in its labors, and thus more fully represent the horticultural interests at the Centennial. No one any longer doubts the immensity of the exhibition, or that visitors from all nations of the earth will assemble in Philadelphia during the continuance of the same.

Nor is it to be doubted that the agricultural and horticultural displays can be made amongst the most interesting. It is to be regretted that these two interests were not made separate and distinct; not that horticulturists will not affiliate with agriculturists, but the task of the commission becomes doubly onerous.

With a latitude varying from that of Maine to Florida, and a longitude varying from that of the Atlantic coast to the Pacific, what nation can in a united region of country present the variety of vegetable growth that we can? Products from every State and territory should be on exhibition.

How this can best be achieved we look upon as a question of great moment for this society. The Pennsylvania Horticultural Society, never exhibited away from Philadelphia, assuredly is not as familiar with the resources of the State as our own, which has, during the last seventeen years, visited every section of it.

We would advise the appointment of a committee of our society to act with the Pennsylvania Horticultural Society, to procure the best specimens of all varieties of fruits and vegetables as they mature, and forward them to the Centennial. There is not the least doubt but that fruit preserving houses of various styles will be upon exhibition. Test their practical worth by storing our fruits and vegetables in them, and designate certain days of each month when a full exhibition will be made of all varie-

ties collected. Persons of a horticultural taste could thus arrange their time of visitation to the Centennial.

Full power should be given this committee to correspond with the officers of other State societies, in order to provide for a grand display during the meeting of the American Pomological Society in September. I doubt not but that our wharves, our market-houses and our fruit stands will make displays to amaze some of the more advanced nations of Europe; but there should be some concentrated action by our various societies, and the manner that I have crudely presented is the most practical one that I could devise.

Yours respectfully,

S. B. HEIGES.

E. B. ENGLE:—I regret exceedingly my inability to be with you at Doylestown. Hope you may have a very full and profitable meeting.

Yours respectfully,

S. B. H.

Mr. Sprout is particularly interested in the Centennial exhibition. When he heard of the appointment of a Centennial committee by this society, he felt it our duty to act as a nucleus about which other societies might gather. We could probably arrange to act in concert with the Centennial board for a full and general display of fruits and flowers. Exhibited a photograph, and explained the design of an apparatus for preserving perishable fruits when on exhibition. Has visited fruit preserving houses in Lockport, New York, on a similar principle, which give entire satisfaction.

Mr. Satterthwaite (President) stated that there is in successful operation, at Bristol, in this county, a fruit preserving house. Hoped some one present would be able to give some particulars concerning it.

Mr. G. B. Thomas stated in reference to making a display at the Centennial, that there can probably nothing be done as a society. All the available space is now taken, and other buildings being put up.

Mr. Meehan agreed with the views advanced by Mr. Thomas. He offered a resolution advising this society to endeavor to co-operate with the American Pomological Society at their bi-ennial session, in September next. That society would be glad to have all their pomological friends meet with them, and we would doubtless receive better recognition if we went as a body.

The resolution was adopted unanimously.

Mr. Engle moved a re-consideration of the resolution just adopted. Felt a delicacy in intruding this society into the American Pomological Society without even an invitation. Is a member of both societies, but thought it out of place for us to meet with them unsolicited.

Mr. Meehan: All societies are invited to be present and participate.

Mr. Pannebaker inquired whether members should bring fruits with them.

The President: The Pennsylvania Horticultural Society will grant space for fruits, flowers, &c., at its annual exhibition.

Mr. Sprout: How is it expected the products from counties or local societies will be arranged without organization or system?

Mr. P. C. Hiller suggested that each county appoint one of their members to receive and display their fruits.

Mr. Cooper, president Lancaster County Agricultural and Horticultural Society: The Lancaster County Horticultural Society looks to this society for some means, or to prepare a way for making a display at the Centennial.

The President: As there seems to be considerable interest manifested on this question, and as others of our society will probably join us before adjournment, I would suggest that it be postponed for the present and the general order of business taken up.

An essay on "Our yards and how to take care of them," by Josiah Hoopes, of West Chester, Pa., was then read by the secretary.

OUR YARDS AND HOW TO TAKE CARE OF THEM.

BY JOSIAH HOOPES.

Although it is a noticeable fact, that our suburban homes in all parts of the country, have been greatly improved during the past quarter of a century, yet very much remains to be done before we can boast much in this respect. What is greatly needed, is a more natural and less artificial system of arrangement. We must break loose entirely from the old idea that straight lines and right angles are the elements of beauty; and in their place substitute the more natural curve and irregular dotting and grouping of our plants.

The latter, however, must be governed by a strict system just as properly as the former, as a mass of shrubs placed in an improper location would surely mar the whole effect of the arrangement. It is an impossibility to lay down any set of rules, whereby any one can improve his grounds. Each yard, however small, seems to have an individuality of its own; there are certain characteristics peculiar to its location, the lay of the ground, the entrance, the views and the exposure, that require a certain amount of study before the general plan is decided upon.

Love trees and flowers as we may, the turf, rich and green, is after all the most attractive feature of any place, however small. The moment we

undertake to cut it up into all manner of flower beds and walks, that instant we commence to spoil its appearance.

In designing improvements of this character, we must remember that every portion of the work must show some specific purpose. Not a bend in the walk must be projected without some real or imaginary cause—to clear a clump of shrubs or other obstruction, and the less walks we have the better. They are expensive luxuries, and do more harm than good, if not kept neatly trimmed and scrupulously clean. The grass too looks far more attractive than when cut up into all manner of geometrical designs.

Whatever is done however, let it be well done, and it will last a life time. Dig the whole surface of the soil deeply, manure liberally, sow the grass seed freely, and you will have a coat of grass worth looking at. Mow it often with a machine, and roll it occasionally. In the spring a slight coat of salt, as well as ground gypsum, will help the sod surprisingly. After the sod has become well established an annual coating of manure in the autumn will not only afford a protection to the grass roots, but it will invigorate them for the ensuing season's growth. The introduction of the little hand lawn mower has done more towards improving our yards than any other invention of modern times. It eradicates weeds, thickens the turf, leaves an even short growth, and by allowing the clippings to remain it actually adds nourishment to the roots. As stated before, let the walks be few in number, but thoroughly prepared. After staking them out, remove the soil and fill up with small stones to within two or three inches of the surface. Place the gravel on the stones, using the coarsest in the bottom, and round off the surface, leaving the middle say two inches higher than the sides. Roll thoroughly until it becomes compact and hard, and this should be repeated after every rain the first season. In succeeding years the walks should be occasionally hoed, raked, and well rolled to prevent the accumulation of moss and weeds.

The question of flower beds is one that requires serious consideration, if we desire to preserve the beauty of our yards; as a perverted taste will disfigure the whole arrangement by introducing a single bed, either in a bad position, or what is still worse, of an incorrect outline. As a general rule sharp angles are inadmissable; what looks well under almost all circumstances, is the easy flowing outline, an area of small, or at the furthest of but medium size, and then a happy arrangement of plants therein. Mixed beds never appear to advantage on a well kept lawn; it is far better to devote the cost of such, to one or two varieties, and arrange these neatly, than to procure one or two dozens, one of each. In front of the entrance door, or of the bay window, at a curve in the walk, &c., are examples where beds mostly show to advantage. If the owner aspires to a fountain, let it be as plain and unobtrusive as possible, else it will detract

from the rest of the grounds. Any one with a little ingenuity can arrange a little rockery in some rather secluded spot, making it to resemble a natural formation, mossy covered, without the mark of a hammer upon the face of the stones. In the centre of the heap, a single jet, or if preferred, several small ones may issue, which, if properly managed will create as attractive an object as the costly marble structure of great pretentions. It is an impossibility to give a general list of trees, and point out the positions of each, but in small places avoid large sized trees; one or two may possibly be inserted where shade is a necessity, but the medium or small sized always look in keeping with their contracted space, and never fill up the whole yard. Avoid mathematical precision in their arrangement, as unlike orchards which are planted for utility rather than beauty, we need a more natural style. Nature however is not a reliable guide to follow; she will not intersperse her trees so as to produce the best effects; she does not have a proper eye for views nor distance; all this we must remedy whilst adopting her suggestions as to the careless grouping and massing, which she so frequently and beautifully offers for our adoption. A flowering shrub placed singly here and there over the lawn, should never be tolerated by any one of taste, as the same number of plants artistically grouped together in a proper position, say in a curve of the walk, in an angle of the dwelling, along the outer boundary of the premises, &c., will form a finished picture. People not unfrequently make a great mistake in setting their trees and shrubs too far apart, for fear of touching after many years; this is all wrong, and modern landscape art requires that all such groups shall interlace and form an outline full of varied forms and colors.

This may be considered more of an artistic idea than a practical rule; but a solitary specimen occasionally standing alone will give the proper idea of form without carrying the system into every feature of the collection. Our trees and shrubs mostly require an annual heading-in of the longer branches, so as to induce a more compact growth. This should not be performed severely, but if attended to in time will produce a favorable impression upon the specimens in after years.

The evergreen hedge will answer a better purpose for the boundaries, provided animals are not allowed to injure it, than any form of wooden or iron fence. If properly pruned and cultivated, the dense wall of green, at all seasons, is particularly pleasing to the eye.

In conclusion, after the place is made it should be carefully attended to, and it will always prove a pleasure to the owner; indeed no place is a home in the full sense of the word without neat, orderly surroundings, be it large or small.

Mr. Meehan considered the essay by Mr. Hoopes perfect, especially in an artistic point of view. Still he did not agree with the essayist in saying

that a few varieties were preferable. Admires a continous succession of bloom from spring until autumn. Thus the eye could have, as it were, a museum to look upon. Still had a lingering love for geometrical lines.

Mr. Engle: It might be considered by fruit growers that this is not properly a subject for discussion by this society. Thought, however, it was. One object in view in proposing a change of name for the society was, a more extended field for usefulness. A greater variety of subjects could be introduced and discussed. Agriculture is the first step in the tilling of the soil. Horticulture is a step forward. Next ornamental, and still higher landscape gardening in all its branches. Thought it altogether an appropriate subject for discussion here, and hoped its consideration would be continued.

Mr. Darlington did not see what folks with small yards would do, as the doctors disagree. Mr. Hoopes wants graceful curves, while Mr. Meehan advises geometrical lines.

Mr. Meehan explained by recommending curves for lawns, and straight lines for gardens and small yards.

Mr. Brower (Bucks county :) Farmers do not all have the means to go into artistic display; but they may have an apple, a pear or a cherry tree for ornament. They may have sheep instead of a lawn mower; thought that many young men of moderate means could greatly improve the appearance and value of their homes by having small and neatly kept lawns.

Mr. Carter thought that one feature of yard ornamentation has not been referred to in these discussions, and that is the importance of climbing vines. Many unsightly objects can be cheaply and effectively covered by them.

Mr. Darlington thought where it is possible in laying out yards, large forest trees should be preferred in preference to planting fancy varieties. Noticed the fine effect produced at the "Experimental Farms," at West Grove, by large trees.

The President: Would have a few large trees where there is plenty of room, otherwise they obstruct the growth of vegetation and mar the beauty of the lawn.

An essay by John I. Carter, of the "Eastern Experimental Farm," at West Grove, Pennsylvania, was next in order.

MANAGEMENT OF ORCHARDS.

BY JOHN I. CARTER.

As this subject is rather too broad to allow the whole ground to be covered in one essay, I shall confine my remarks to a few practical hints, embracing my own experience in the management of orchards.

I might preface, however, by stating my firm belief, that judiciously selected and well managed orchards will pay, and that farmers will find it profitable, and greatly to their interest, to give more attention to this department of their farms. It is common to say that if farmers grew much more fruit they would soon overstock the market, forgetting that as the supply increases, and as these products are freely offered in the market the tastes of the people grow in that direction, and fruit becomes a necessity when before it was only a luxury. I remember twenty or twenty-five years ago, when dwarf pears first became popular, and an impetus was given to pear culture, it was confidently asserted that this branch would soon be over-done, and that pears would be a drug upon the market, yet notwithstanding the great increase in production we had no difficulty in selling our pear crop this year at better prices than ever before. Hence, I think farmers need have no fear of a permanent glut of really good fruit, but might very safely make considerable additions to their orchards, and give them more careful attention. One word now as to varieties to plant. I intend my remarks on this point, as well as on some others, to be more appropriate to farmers than to amateur fruit growers or regular orchardists, both of these classes would probably plant many varieties as specimens, as tests, and to keep up a complete succession, but for plain farmers who want reliable, easily managed trees, and marketable fruit, but few varieties are needed. Among the apples, the Maiden's Blush, Smoke House, and Smith Cider, would be the three safest as stand by's. Among the pears, the Bartlett, Seckel and Lawrence would occupy the same position, while the Governor Wood and Early Richmond cherries would generally be safe to rely on.

These varieties do well, almost anywhere in eastern Pennsylvania, and the fruit is known and valued in the market. For my part, I do not like any of the above mentioned apples, as eaters—but they sell, and the trees are bearers, and hardy.

I do not mention peaches in this connection, because we can make no successful competition with this fruit, with our Delaware and Maryland neighbors.

In regard to the treatment of orchards, I believe it is with trees as with any other crop we raise, judicious manuring and good cultivation give the most paying results.

Trees cannot grow too rapidly, *provided*, it is a healthy growth; such as would result from a timely supply of all the needed ingredients and conditions wanted to make it such. And when the bearing time comes, there must be no cessation of food and care, as is too often the case.

I have always objected to Mr. Meehan's practice of *non*-cultivation, principally because it too often led farmers into a neglect of their orchards at the very time they needed most attention In following his plan they too often stopped at the *grass*, and neglected the *manure!*

To secure healthy trees and good crops of fruit, not only requires the ground in good mechanical condition, but a plentiful supply of available food of such variety as meets all the requirements of the trees. Experience has shown that in many localities we cannot grow a perfect crop of wheat with a purely nitrogeneous manure. We can make, perhaps, a great weight of straw, but not that bright perfect stalk farmers like to see, and bearing a head of well developed grains. We must use *mineral* fertilizers, or in some way make those in the soil more available. So it is, I conceive, in growing perfect trees, or making perfect fruit. We must insure them an abundant supply of mineral fertilizers. I think this was demonstrated in our orchards the past season. We had the most perfect fruit we ever grew—indeed the finest I ever saw. Some of our Bartletts weighed 17 ounces each, and otherwise perfect. Our Seckels brought from $4 to $6 per bushel, and our apples were fine, though this was our off year. Our orchards have heretofore been rather unthrifty in growth and bearing, but latterly we have been giving them better cultivation, and using phosphatic fertilizers freely on the hoed crops between the trees.

Our treatment, the last season, was about as follows:—We gave them the usual winter pruning, which was slight, merely cutting out injured limbs and water-sprouts, and those that interlocked—and cut back some of the most wayward and rampant branches, keeping the tree in reasonably good shape, with as little pruning as possible. We then washed or painted the trunks and larger branches with a composition of one-half bushel of muriate of potash, the same quantity of cow manure, five pounds of sulphur, and one barrel of water. Previous to this, and during the winter, a light coat of yard manure had been applied; the ground was then carefully plowed and planted with potatoes, giving them a good dressing of acidulated South Carolina rock. Immediately under each tree we sprinkled five pounds of muriate of potash. We find this muriate the cheapest form in which we can buy potash. It costs about two and five-eighth cents per pound, and analyses about forty-five per cent. of potassium.

As the ground contained pretty plenty of lime, we thought we had furnished the most needed materials for maturing wood and making healthy trees, and the result fulfilled our expectations. The trees held on their fruit, and retained their foliage, till late in the season. We suffered very little from blight or disease.

Of course we do not raise and sell crops, on our experimental farm, to the best pecuniary advantage, for two reasons:—First. It is an experimental farm; and Second, Our limited means prevent us from doing any of the many things undertaken very well. But we marketed, this year, one hundred and thirty dollars worth of Gov. Wood cherries from twelve or fifteen trees, and over four hundred dollars of Bartlett pears from one hundred and fifty bearing trees, and sold one hundred dollars worth of apples from an orchard of the usual farm size. Special attention to thinning fruit, and marketing to the best advantage, would have increased our receipts. I only mention these figures, to show what can be done with an orchard with but tolerable treatment.

Mr. Purman asked for practical advice on the care and management of orchards. Has 100 acres in apple orchard and would like to have the opinion of this society as to the best and most economical means of growing and fruiting them. Inquired what crops could be planted in so large an orchard so as not to injure the trees, and at the same time be profitable.

Mr. Magill: In the first place, from nothing we can expect nothing. Intelligent New York fruit growers claim that an orchard increases in value one dollar per tree each year.

If Mr. Purman has 100 acres of orchard, containing say 4,500 trees, some time and labor must be expended to realize an increase of $4,500 annually in the value of his orchard. If he is not prepared to properly cultivate 100 acres, he had better try fifty, or ten, or even one acre.

On the other hand, if he has 100 acres and can carry out his plans, would advise hoed crops for the first six or eight years—potatoes being especially suited to the purpose.

Three hundred or 400 pounds of phosphate to the acre should be used, and the crops would assist in paying current expenses. After that time the orchard could go into grass, and should be mowed once or twice a year. The grass could either be used as a mulch, or, if removed, manure should be put in its stead. Stock should be excluded; advocated low trimming, and would prune his orchard from middle of May to July 1. Prefers low branched trees, because he can pick cheaper from the ground than from ladders.

Mr. Sprout: It was my fortune to pass throug the apple belt of New York State sometime ago, along Lake Ontario from Rochester to Buffalo. Found upon inquiry that the usual practice was to raise hoed crops three

to four years after planting, after which they are allowed to run to grass. This is usually mowed and left to rot on the ground. Thinks wood ashes one of the best manures for fruit trees. For blight would use a solution of copperas poured to the roots of the trees occasionally.

Mr. Darlington introduced Mr. John Eastburn, the veteran apple grower of Bucks county, and asked his views upon the management of orchards.

Mr. Eastburn: Instead of corn would recommend potatoes as an orchard crop; objects to plowing under corn because it has a tendency to dry up the soil; prefers clover or buckwheat for plowing under; would grow neither wheat, rye or oats as a crop, and always keep out stock; he believes in perpetual cultivation; plows under his trees and close to them but quite shallow, the object being to keep down the grass; manures his orchards but not heavily; thinks manure has a tendency to produce wood and sap; likes chip-dirt or road-washings as manure; last year he marketed 2,800 bushels.

Mr. Magill spoke of the orchard belonging to Mr. Joshua Fell, near Doylestown, whose trees resembled pyramids of fruit; the trees are twelve years old and the crop worth from $10 to $13 per tree; the grass in the orchard resembles a well kept lawn. In reply to an inquiry, Mr. Magill stated that the head or lower limbs of a tree should be three or four feet from the ground.

Mr. Gardner, a practical tree-trimmer, explained his theory and practice in pruning. His object was to obtain short trunks and large, broad tops, securing thereby a rapid and healthy growth; would allow only three branches and from them form the head of the tree; many trees are so dense with leaves and branches that the air and sap cannot circulate freely; others had too much food, and on poorer ground would have yielded more fruit.

The President: To have trees thrive properly would have the leaves as near the roots as possible by heading them low and keeping them trimmed, as they grow they will never need staking.

Mr. Lint, (York county,) preferred spring pruning. In fall pruning the wood is apt to dry out too deeply. Would begin to prune as soon in February as weather would permit and continue until sap starts. When pruned in May or June, trees are apt to bleed and get black. Agrees with the other speakers, that trees should be started low, but would trim up gradually, so as to be able to get under with horse and cultivator or plow. Would cultivate young orchard with potatoes six or eight years, then put in grass. Thinks clover and potatoes draw their nourishment largely from the air, and consequently do not exhaust the soil. Wheat should not be sown in an orchard.

Mr. Meehan thought that while low headed trees might be preferable in other respects, they might not be best near a theological institution. How to treat and manage a young orchard successfully, will depend upon circumstances. At a very great distance from market, potatoes or corn might not be profitable. In such a vicinity grazing would probably be best. Hay and grass require less rich manure than almost any other crop. Street washings as a top dressing would probably be most economical.

On motion, the president appointed Samuel W. Noble, Thos. M. Harvey and John I. Carter, a committee of three to examine and report upon the fruits on exhibition.

Mr. Engle moved that the hour for morning session be fixed at eight o'clock.

Mr. Hiller moved to admend by making it half-past eight instead of eight o'clock, and the motion as amended was adopted.

Adjourned.

THURSDAY MORNING, JANUARY 20.

Meeting called to order by the president, who appointed John I. Carter, Thomas M. Harvey and A. S. Sheller, a committee to nominate candidates for the several offices for the ensuing year.

The committee appointed to audit the accounts of the treasurer, submitted a report which was read, accepted, and the committee discharged.

Deferred business being next in order, the question of changing the name of the society was again taken up.

The president stated that a motion to confirm the name proposed at last annual meeting would be in order.

Mr. Meehan has always opposed a change of name, and only yielded because a majority seemed to favor it. We have already a society of that name, and for this body to adopt a similar one, may create confusion and difficulty. Further, this society has gone to considerable expense to have engraved a lithograph certificate of membership, which would be a total loss. Thought the matter had better be postponed until next annual meeting.

Mr. Engle agreed with Mr. Meehan. If our field of usefulness could be extended without a change, would prefer retaining our present title.

Mr. Noble and Mr. Lint also opposed a change.

Mr. Engle moved the indefinite postponement of the subject.

Mr. Meehan thought that in deference to the wishes of the members not present, it had better be postponed for one year.

Mr. Engle withdrew his motion, and on motion the further consideration of the subject was deferred until the next annual meeting.

The following preamble and resolution were offered by Mr. Carter, who moved their adoption:

WHEREAS, We deem it desirable that our society, as the representative of the fruit growers of the State, should make a creditable and profitable display of our fruit products at the Centennial Exposition:

And whereas, We believe that if the matter is left to private enterprise the want of systematic arrangement and judicious selection will greatly mar the show and hinder any satisfactory comparison of fruits from different sections; therefore,

Resolved, That our secretary be instructed to correspond with the officers of the county agricultural societies, requesting the appointment of a member of their society, to act with others similarly appointed, as a committee to take charge of and arrange all fruit sent in their care.

The secretary further asks said officers of county societies to use their best endeavors to secure a full display of fruit from their various sections

Mr. Harvey: Some arrangements should first be made to secure space for a display.

Mr. Burton inquired what had been done by the Centennial committee, appointed by this at its last annual meeting.

The President: As chairman of that committee, had no report to make. Tried to ascertain what to do, or what had been done, but was unsuccessful.

Mr. Carter: Did not hear the minutes read, and consequently did not know what had been before the meeting. Thought it proper to have a committee appointed to make a display. Referring to the matter of space, thought most of the counties had procured space.

Mr. Meehan agreed that something should be done to represent Pennsylvania's fruit products at the Centennial. Such a display, to be gotten up properly, would cost time and money. While some States have made liberal appropriations for this purpose, our State has done nothing. Everything seems so indefinite that he did not see how it could be done.

Mr. Engle believed that all would agree as to the necessity of doing something. Suggested that the Centennial Committee be discharged, and a committee of three or five appointed to confer with the Centennial Commissioners, and see what could be done, and how.

Mr. Darlington thought the most direct and practical way would be to correspond with Mr. Landreth, Chief Bureau of Agriculture. Thought if an offer of co-operation were made by this society it might be accepted. We cannot take any initiatory steps; can only come in as an auxiliary.

Mr. Harvey felt ashamed that Pennsylvania could not do anything, when other States are preparing on so large a scale for a grand display, could not see where there would be much expense. The greatest labor would be in selecting specimens suitable for exhibition.

On motion, the further consideration of this question was postponed for the present.

The question of orchards and their management was again resumed.

Mr. Harvey stated that he had made some experiments in pruning when at the experimental farm, had cut off branches on twenty-third day of every month for one year. He requested Mr. Carter to state the result.

Mr. Carter could not report definitely. Limbs cut off in January and February, and in June, seemed to heal over best. Those cut in spring and late fall did not do so well. The general result was rather in favor of early winter pruning.

Mr. Meehan: As a rule a wound made in summer would heal more rapidly, but in practice preferred fall or winter pruning.

Mr. Harvey thought we all agree to prune when the sap is dormant.

Mr. Engle: Pruning at best, especially heavy limbs, is an evil. If properly understood and managed, all necessary pruning could be done with pen knife. It may not always be practicable, but this is his idea, never allow a tree to grow so as to need heavy pruning.

Mr. Purman asked Mr. Magill's experience.

Mr. Magill agrees with Mr. Meehan that large limbs will heal over faster when the tree is growing. Practically, however, would prune early in winter.

Mr. Sprout: When the foliage starts, pruning can be done with safety.

Mr. Meehan in some verbal remarks, considered the subject of

"HYBRIDIZATION OF FRUITS BY DESIGN."

This question is of considerable scientific importance. We are apt to think we are not progressing at all, and it is only by reflecting upon what has been done in the past, and what we are doing now that we can see how much has been gained. People might ask of what use these things are; we might as well ask the use of a new born babe; we must wait and see the value of new born thoughts. There are many scientific facts which do not seem valuable when first brought to notice, but become valuable in course of time. The hybridization of fruits is a subject of this class. Two hundred years ago nothing was known or practised in the way of hybridization. Two thousand years ago there was an indistinct idea concerning the subject; knowledge on this point has grown very slowly and thus far we have not derived any decided advantages. It is not probable that the process is immediate in its effects upon fruits. Corn, melons and the squash family are exceptions. There is probably a closer natural affinity between them.

Like does not always produce like, no two trees of the same kind are exactly alike; fruits and seedlings are not alike. There is an inherent natural law of change which is always going on. The results of cross-fertilization frequently vary. Sometimes there are no characteristics of the female parent, while frequently there is a perfect blending of both; sometimes all traces of the male parent are lost in the offspring. The experiments of Mr. Parkman of Massachusetts, were briefly referred to.

In attempting the hybridization of the lily, the flowers and seeds were perfect, but out of some hundreds of experiments, the female parent was always exactly re-produced. Mr. Engle, of Marietta, Pa., who tried to cross the apricot and peach, succeeded in getting a perfect peach.

Remarkable success has followed the hybridization of different varieties of grapes, especially the attempts of Mr. Rogers, who has succeeded in crossing the common fox grape with other varieties, and to whom we are indebted for the well known "Rogers' Hybrids." Many of these are excellent, and well worthy of cultivation, but it is doubtful whether they are as good, and as well adapted to general cultivation, as some of our natural seedlings. Mr. Downer, of Kentucky, also had some good seedlings crossed by design, but none better than some that have grown spontaneously. So also of the seedlings of Mr. Clapp and Mr. Dana—a few only are worthy of dissemination, while none are equal to some of the varieties of pears that were accidentally discovered, and have long been under cultivation. In brief, cross-fertilization, by artificial means has, thus far, been of little practical benefit to fruit growers, and natural processes in the future, as in the past, will doubtless produce the best results.

Mr. Engle would not discourage cross-fertilization. Aside from his efforts to cross the apricot and peach, he made various experiments with strawberries; tried to cross the well known "Albany seedling" with "Ladies pine," in the expectation of raising a new seedling that would combine the quality and flavor of the one, with productiveness of the other. In this particular instance the result was just the reverse of what he expected, though some of his other crosses and seedlings are valuable, and worthy of cultivation. His experiments with apricot and peach were quite satisfactory; has secured a seedling peach from ten to fifteen days earlier than Hales. Will make still further experiments by re-crossing with other varieties. Thought the matter was governed by some unerring natural law, which, if we understood rightly, would accomplish some definite results.

Mr. Harvey questioned whether there is really no advantage in hybridization, especially the theory advanced by some, that the male parent gives only life and not character. Thought the doctrine wrong when applied to live stock.

Mr. Burton: Had some experience in cross-fertilization of plants, but not fruits. His experiments were generally satisfactory and successful.

Mr. Meehan: Did not wish to be understood as saying, that new varieties could not be obtained; but that is not what we desire in fruit culture. The florist wants a greater variety of flowers and plants, but fruit growers wish to improve the quality, without increasing the varieties.

Mr. Engle: Had, at one time fruiting, several thousand seedlings, the result of about two hundred different crosses by design. Almost, without exception, those that he tested partook of the nature of both parents, and their origin on both sides could easily be traced. It is still evident to his mind that improvement can be made, and that, by close study and experiment, we may expect gradually to understand the hidden natural laws that govern this principle.

The next regular subject for consideration and discussion was opened by Mr. Noble, in an essay on

THE CULTIVATION OF THE APPLE.

We all know that the apple tree grows in all sections of our country where proper care is given to it, and even in many situations without much care if circumstances are favorable. Notwithstanding I think it will well repay the planter to give the trees the proper care in cultivation and planting, not as is sometimes done, digging a small hole in the sod not large enough for the spreading of the roots, then cramming the roots into it, tramping the dirt put on them with the foot, so as to make it solid enough to keep the tree upright, but in setting an orchard the holes should be made large, and if the soil removed is not in a high state of cultivation, good earth or compost mixed with the soil should be put in, nearly filling the hole, set the tree on this, placing the roots around, and covering dirt so as to fill up the interstices between the roots. The tree should be so planted that when the earth settles the tree should be but little deeper in the ground than it was before being transplanted, though some plant nearly on the top of the ground covering the roots and raising the ground around the tree above the general surface of the field, which may do better for low moist ground than high dry situations. In planting in the spring during dry weather it may be proper to use water on the trees, which should be done when the holes are nearly filled up. It is well also to put a mulch of straw or long manure to protect the tree from the effect of dry weather the first summer, but in fall planting I do not think it needful to use water, but the earth may be banked up around the tree to hold it from being swayed about with the wind and protect the roots.

It is generally conceded that it is best to cultivate the ground for a few years after planting, with corn or root crops with a liberal allowance of

manure, though some, like my friend Meehan, apply a top dressing of compost or earth from ditches or fence rows sufficient to keep the grass from growing and the ground loose around the tree, but in sections where the striped apple tree borer abound care must be taken to keep them out, or destroy the larva which eats around and in the tree, girdling it or so weakening it that the wind will break it off, thus killing the tree. Some persons suppose when they see the small holes near the surface of the ground there is the place where the worm entered, when the fact is the insect or worm that made the hole has come out and done all the injury it could to the tree, and has changed to a striped beetle three-fourths of an inch in length, and is preparing to lay its eggs on other trees to hatch out and destroy them. It usually makes its appearance in the sixth month, sometimes later, and soon commences to lay its eggs in the small crevices of the apple tree near the surface of the ground. As soon as the eggs are hatched, which is usually a week or more after they have been deposited, the young larva bores into the inner side of the bark, eating down between the bark and wood into the roots where it generally spends its first winter, next season as it becomes larger and stronger it bores more into the wood, passing up near the surface of or above the ground, after eating out to the bark in the fall prepares to change to the bug or beetle, and eat out through the bark, leaving the holes before mentioned.

The best remedy is to prevent the female from depositing her eggs on the tree at the surface of the ground, by covering it with paper, leather or tar around the tree a few inches high, will answer if done at the proper time, which is the spring and early summer months, and in the fall remove the covering, and if there are any worms in the tree, they will show themselves by the worm dust coming out of small holes; where with a small blade of a knife or piece of wire, they can be easily taken out and will not hurt the tree, without there are several in a small tree. When taken out early, the tree will soon heal over; if neglected, they grow larger and more deeply embedded in the wood and more difficult to destroy, but with a suitable piece of wire with a small hook on the end of it, they can generally be gotten out. I have sometimes, after following them up in the wood of the tree, found by using the point of the knife, the place in the bark where they would come out in the beetle state, and by introducing the wire, destroy and take them out through the bark.

"Driving spikes and nails into the trees or boring holes into them, and filling them with sulphur, calomel, arsenic or any other substance, is altogether useless. Some scrape out the wounds and draw the earth away from the trees and leave the roots exposed for weeks and months, but if this is done during the fifth, sixth or seventh month, it only exposes the trees and invites the females hither to deposit their eggs; others, when so

exposed, apply lime, ashes, alkalies, soaps, &c., although each of these may do some good if properly applied and at the right time; yet prevention is anterior and superior to them all; these remedies, as well as the dry exposure may assist in destroying the eggs after they are deposited, or kill the young grubs after the eggs are hatched, for they require moisture for their development, and either a hot sun, dry air, or dry lime or ashes may absorb the necessary element and defeat the insect, if it reaches the objects intended to be effected at the right time, for after they have penetrated the solid wood of the tree, it must be evident that no applications of these kinds would be of any avail in dislodging them."

WHAT ARE THE BEST VARIETIES TO CULTIVATE?

This is an important question, for our success or failure very much depends on the selection of the proper varieties; for no matter how well the ground may be prepared, or how well the trees are cultivated and attended to afterwards, if the varieties selected are not suited to the locality or soil the planter's expectation will be likely to be disappointed when the trees come to fruit.

Downing names and describes in his work on fruits over 1,800 different varieties of apples; no doubt these were *all* well thought of in some section or place or they would not have been named and description given of them; no one would want to plant all of these to find out the best, nor would he want to plant the 100 selected varieties recommended by him, some of which are especially recommended for the South and South-west, others for the North and North-west, the other no doubt are valuable in some localities but how far they are suited to this or other sections can only be ascertained by taial.

With regard to the varieties suited to each locality I may say after all the recommendations made by pomological and fruit growers' societies, there is no certain guide but experience; hence, each one intending to plant should look in his own locality and neighborhood and see what varieties succeed there and plant principally of those varieties, or if he want more varieties plant some of them that are recommended to test their suitableness in his locality.

For an apple that has originated in a certain locality and is found to suit in quality of fruit, productiveness, time of ripening, &c., when it becomes known will be generally planted; thus local varieties are continually coming into notice in various sections and parts of our country; so in this section we have the Smith's Cider, a well known variety more extensively planted than any other variety, on account of its great productiveness; also, the Townsend, Cornell, Tracy and Princely Jackson, the latter, perhaps, not so well known as the others, was raised by James Jackson of Quakertown,

and is considered a valuable Winter apple. The Fallawater, Maiden's Blush, Smokehouse, Ridge Pippin, Cope's Redling of Rigley and Wine or Hays are reliable apples.

I will name some from other sections which are not so well known but are worthy of trial:

SUMMER APPLES.

Early Strawberry, a small sized dark red apple, good quality.

Early Joe, a small, striped apple of excellent quality.

Jeffries, a fine table apple, from Chester county.

Summer Hagloe, a large, showy apple, much planted in New Jersey for market.

Benoni, a red striped apple, medium size, good for the table and market.

FALL APPLES.

Cumberland Spice, a good sized yellow apple and good bearer alternate years.

M'Lellen, a very good, tender, flesh-red apple.

Belmont or Gate, an excellent fall apple, sometime inclines to rot on the trees.

Stackyards.

For winter varieties: Bullock pippin, small but excellent quality.

Krouser, Heister, from Berks county.

Turn of the Lane, or Winter Strawberry

York Imperial, a good winter apple, extensively planted in York county.

French Pippin, a large, green-yellow apple, cider, valuable in the neighborhood of Quakertown.

In conclusion, while I would encourage amateurs and nurserymen to test all the varieties they think will be valuable that come under their notice, I may say it is better, particularly for market purposes, to plant a few varieties of good bearing trees ripening in succession, of fair quality, than a large number of fancy kinds which, perhaps, are very good but are not reliable.

In reply to an inquiry concerning the Baldwin, Mr. Noble said that he considered it a good fall apple, but would not recommend it for winter. It is a good bearer alternate years, but as tree becomes older fruit will not ripen so well.

Mr. Magill: Had not much experience with Baldwin. Had planted some, and had top grafted off with Smith's cider.

The President: My experience with the Baldwin has not been satisfactory. The best early apple I have tried is Princes' Early Harvest. Next is Red Astrachan, which is the finest early apple I ever saw, though not so productive as Early Harvest. Summer Hagloe is a little too late.

Mr. Noble: Early Harvest cracks some, but considered it one of the best. The Red Astrachan is fine, but not so good a bearer. Mr. Ott had 10 acres of Red Astrachan, but has changed some to Early Hagloe.

Mr. Lint: Red Benoni is the best early apple I have. Ripens very gradually. Can market it 3 to 5 weeks.

Mr. Engle inquired whether Early Strawberry and Red Benoni were identical. Asked also for information concerning Jeffries.

Mr. Bartram has two trees of Jeffries, 18 years old. Considers them the best apple he has. Primate also No. 1. Tree vigorous. Fruit should be picked before fully ripe.

The President: With me the Primate is not healthy; is subject to a kind of blight.

Mr. Hiller: Benoni is considered one of the most profitable early apples we have in Lancaster county.

Mr. Pannebaker: E. Harvest often sell at $1 to $1 50 per bushel, when Astrachans are down to 50 cents. Considers E. Harvest *the* apple.

The President spoke highly of Cornell's Fancy, which is a native of Bucks county.

Mr. Bartram has but one tree of Summer Hagloe in bearing. It is large and handsome and more profitable than any other. Has planted about 30 in his young orchard. With him Astrachan has rotted badly.

Mr. Williams has had Summer Hagloe in bearing seven years. Has borne more fruit than any other variety except Smith's Cider. Thinks Benoni and Early Strawberry are distinct varieties.

Mr. Engle recommended All Summer. It is rather small but has no superior in quality and productiveness in his vicinity. Garretson's Early, a fine apple, larger than E. Harvest or Primate, and in quality equal to Early Harvest. Astrachan does not succeed well with him.

Mr. D. G. Engle had planted R. Astrachan alternately in rows with standard pears. Did not prove productive, and were removed.

The President considered Early Joe the best early apple for home use.

Mr. Noble named Early Strawberry as a valuable market apple. Is not subject to rot, does not easily bruise and will always sell.

Mr. Sprout has probably Sour Bough instead of Early Harvest. His fruit ripens irregularly and is small.

Mr. Cooper: Have in our vicinity Prince's Early Harvest and another variety similar, but not quite so early. Thinks the latter more profitable and a stronger grower.

Mr. Lint: Can tell the Early Harvest by the tree as well as by the fruit. Has two trees from the same place, but one bears finer fruit and is more productive than the other.

Mr. Noble: For fall apples would highly recommend Cornell's Fancy.

Mr. Magill: While Cornell's is a favorite with some he would prefer Townsend; they both ripen in peach season and are not profitable. After Red Astrachan none are profitable until Maidens' Blush, which comes in after peach season. It is one of the best for market and family use that we have. It may be picked early and kept until after peach season.

The President: Is Smokehouse satisfactory anywhere?

Mr. Moses Brinton: No apple sells like it in our neighborhood; it is the best apple we have; am surprised that the Smokehouse is not more generally spoken of and recommended.

Mr. Pannebaker: Smokehouse is one of the best varieties in Mifflin county.

Mr. Engle: One of the best in Lancaster county and out sells any other in its season. It is not so regular and sure a bearer as some, but of fine size and quality, and when perfectly grown will keep to mid-winter.

The President: These remarks seem to confirm the theory that all fruits do best in their own locality.

Mr. Engle: Almost every locality has its favorite, though the rule is not universal. Some kinds succeed well over a large scope of country.

Mr. Sheller: Smokehouse in Union and Northumberland counties does very well; two years ago ate the fruit in May.

Mr. Magill: Has a few trees, not very full bearers.

Mr. John Eastburn has trees of Smith's Cider, that have borne every year since planted, 45 years ago. Did not bear full crops every year.

Mr. Meehan: Some trees have a constitutional habit of bearing only every other year.

Mr. Sheller asked for information concerning Lawver, Ben. Davis and Grimes' Golden.

Mr. Meehan: Lawver originated in southern Illinois. Does not seem to make much headway. Is not specially valuable more than for its beauty.

Mr. Brinton: Fallawater with us bears every year.

Mr. Bartram: Pound is about the most profitable apple grown in our vicinity. His neighbor never plows or manures his orchard, but has apples every year.

Mr. Sprout inquired whether Fallawater and Paradise are identical.

Mr. Harvey: Paradise grows tall and erect like Lombardy poplar. Fallawater has a spreading habit.

Mr. Purman asked how many and what varieties to plant for profit. Would like to know the best half dozen varieties of winter apples.

Mr. Sheller asked for information concerning the 20 ounce.

Mr. Lint advised Mr. Purman to ascertain what varieties succeed best in his vicinity, and make a selection therefrom. With him 20 ounce is a regular bearer.

Mr. Harvey thought it ridiculous to meet in Bucks county and not mention Smith's Cider. Although the leading apple here, he considers it inferior in quality.

Mr. Magill: Smiths' Cider in Bucks county speaks for itself He asked Mr. Eastburn, who grows it extensively, to give its origin and history.

Mr. Eastburn knew the farm on which the original tree grew. It is in the south-east corner of Buckingham township, Bucks county, on the farm now occupied by Jacob S. Livezey, and formerly owned by John Smith, who first grafted the fruit. The tree was discovered in a hedge row about 85 years ago. Mr. Eastburn knew the tree fifty years ago. Mr. Smith's trees bore fruit every year. The grafts were taken to the vicinity of Auburn, N. Y., for trial but the fruit did not succeed there.

Mr. Meehan asked a remedy for bark louse. Had tried potash water, whale oil, soap, sulphur, and other remedies without much effect.

Mr. Engle during the past season had found the bark louse worse than ever before. Always understood that caustic lye, or preparations of that kind would destroy it. Applications should be made in June, just after the eggs are hatched.

Mr. Harvey: Whale oil soap tied on the branches of trees and left to dissolve by rains, had been found effectual.

Mr. Bartram had cleared trees of bark lice with two applications of common soap applied with a whitewash brush.

Mr. Sprout gave the ingredients of a recipe which had been applied with success in destroying insects of all kinds on fruit trees. It is as follows: 2 lbs. copperas, $\frac{3}{4}$ lbs. blue vitriol, $\frac{1}{4}$ lb. saltpeter, 4 lbs. hard soap, and 4 lbs. salt. Two or three ounces of this mixture tied in a bag and placed upon a tree, was an effectual remedy wherever tried.

Mr. J. Q. Atkinson recommended whitewash, applied about June 1st.

Mr. Pannebaker: Had used Babbitt's potash, mixed with a little turpentine, with success.

Mr. Engle: Thought probably each ingredient might have the desired effect. These remedies might do for individual trees and orchards, but would hardly be practicable in a nursery.

Mr. Bartram cautioned members about the use of salt. Had known young apple trees to be killed by it.

Mr. Eastburn recommended scouring the trees with a mixture of soft-soap and sand.

Mr. Atkinson said, that the exclusion of air at the time of hatching was the object desired, and whitewash would do that as well as anything.

A motion was made, and carried, that the afternoon session convene at two o'clock.

On motion, adjourned.

AFTERNOON SESSION.

After calling the meeting to order, the following report of the Committee on Nominations was received by the president, and read by the secretary:

President.—Edwin Satterthwaite.

Vice Presidents.—Samuel W. Noble, H. M. Engle and Tobias Martin.

Recording Secretary.—E. B. Engle.

Corresponding Secretary.—W. P. Brinton.

Treasurer.—G. B. Thomas.

(Signed) JOHN I. CARTER,
THOS. M. HARVEY,
ALF. S. SHELLER,
Committee on Nominations.

On motion the secretary was directed to cast a ballot bearing these names and they were declared elected.

The selection of a place for the next annual meeting was then taken up.

Mr. Brinton moved that the society meet in Lancaster.

Mr. Engle thought that out of courtesy to our friends in the western part of the State, the society should meet there. Suggested, as that part of the State was not generally represented at this meeting, that the place be left open and fixed by the executive committee.

Mr. Sprout suggested Williamsport or that vicinity; thought some valuable material could be gotten into the society there.

Lancaster and Williamsport being named, a vote was taken which resulted in the selection of Lancaster.

In the absence of the regular treasurer, a motion was made and adopted, that the treasurer elect, Mr. Thomas, assume the duties of his office immediately.

The President stated, the question under discussion at the time of adjournment this morning would be resumed. Requested Mr. Noble to say something concerning the habits of the Codling moth.

Mr. Noble stated that this insect attacks the fruit, not the tree. The eggs are laid in the calyx of the young fruit, the hatched grub penetrates it, and towards maturity works its way out. It often finds refuge in the bark of the tree. The best preventative known is the straw or hay band or anything similar that will furnish a hiding place. They can be removed every few weeks and destroyed and replaced by others.

Mr. Sprout called the attention of the society to a new device for the destruction of the Codling moth, and explained its use and method of application. It consists of an elastic rubber band, some two inches wide, and would cost from fifteen to fifty cents each.

Mr. Meehan had found that the simple process of tying hay or straw-bands around the trunks of his trees was better than anything else.

Mr. Engle: Nothing of this kind will prevent the first brood of Codling moth from attacking the fruit. They fly to the trees and do not crawl upon them. It is only after the injured fruit falls to the ground, and the worms are seeking places to form their cocoons that these remedies are useful. Thought the trap which was exhibited by Mr. Weir before the American Pomological Society at Richmond, was one of much value, on account of its simplicity and cheapness.

Mr. Meehan: Mr. Weir now admits that hay-bands are even better than his trap. Since using them, and picking up the falling fruit, has but little fear of the Codling moth.

The president explained his method of destroying the moth. His trap consists of two old shingles tacked together. New ones will not answer. About every two weeks the shingles are examined and the worms removed. Soon as fruit begins to fall it is picked up and removed.

Dr. Dickie: Had turned a flock of chickens into his orchard, and finds the moth much diminished in consequence.

On motion, the further consideration of this question was postponed for the present, and the subject of pear culture was taken up. Before opening the discussion the following communication was presented to the society, and ordered to be published with the proceedings:

WEST GROVE, PA., 12*th* 30, 1875.

To the Pennsylvania Fruit Growers' Society:

The Experimental Farm Club of West Grove has appointed Thomas M. Harvey, John I. Carter and Mark Hughes as delegates to represent said club at your meeting, to be held January 19, at Doylestown. This to be their credential and also for any other member they choose to appoint.

N. R. SHARPLES, *President.*

JOHN I. CARTER, *Secretary.*

In reply to an inquiry, the President stated that the most profitable pear for Philadelphia market, which ripens before the Bartlett, was Manning's Elizabeth. It is very productive and ripens in August.

Mr. Meehan called attention to the great number of failures in pear trees, especially dwarf. A large orchard in the vicinity of Germantown had failed entirely. Old and large trees in the vicinity of Philadelphia seem healthy. This is especially the case with the old Catharine variety, which is remarkably free from disease. Inquired whether anything in our system of cultivation or in the stocks used for propagation might be the cause.

Mr. Carter: Saw a few weeks ago, in Maryland, an orchard of 4,000 dwarfs planted two years ago, which was remarkably healthy. The owner intends planting 2,000 more trees in the spring.

Mr. Harvey asked whether the introduction of foreign varieties might not be the cause of failure. Mr. Berckman's theory is that few of the foreign varieties will succeed well here. Even the Bartlett is not certain yet. Better plant the Lawrence, Seckel and other native sorts.

The President did not agree with Mr. Harvey. Puts Duchess, a foreign variety, at the head of the list. With him Lawrence blights considerably.

Mr. Meehan: All the old pears are of foreign origin.

Mr. Thomas: The Duchess in the vicinity of West Chester is of no value.

Mr. Sheller: It does well in Union county.

The President: Would always plant Duchess on quince.

Mr. Magill inquired the best remedy for the pear slug. Had used air-slaked lime with success.

Mr. Thomas: Dust or ashes will answer.

Mr. Sprout has tried dust, ashes and lime, all good.

Mr Bartram, in reply to an inquiry whether barn-yard manure was injurious to pear trees, stated that the largest pear tree of which he has any knowledge, stands at the corner of a barn-yard.

Mr. Brinton was induced to believe that barn-yard manure was injurious to trees. Had mulched heavily with it, and lost a number of trees by fire-blight.

The President has lost many trees by fire-blight during the past 4 or 5 years, but ascribed it to drouth. Manures all his cultivated ground. Those that get no manure blight rather more than those that do.

Mr. Meehan has never seen any fire-blight in the vicinity of Philadelphia. Knows of large trees in and near barn-yards that do just as well as any. Has seen trees thrive that had manure heaped up around them. Manuring on the surface is best for orchard trees.

Mr. Carter has great faith in mineral fertilizers. With him none have done better than South Carolina rock; it is a phosphate and would recommend it for trial to fruit growers generally.

The next question—"Should northern and eastern winter fruits be recommended for cultivation in southern and eastern Pennsylvania?"

Mr. Magill would not recommend northern and eastern fruits in this vicinity. Trees from there planted ten or twelve years since, have not proven satisfactory. Had lost considerable himself in planting these varieties, and thought the loss in Bucks county alone would reach $1,000,000.

Mr. Carter stated that last fall at the Oxford fair, Mr. Darlington Cope exhibited some thirty or forty varieties of southern apples which were of much promise. They were late keepers and would make good winter apples.

Mr. Meehan thought there is great misconception in the minds of fruit growers with regard to this subject. It is not always correct to suppose that our own varieties do best. Very often varieties from a distance do better, and this can only be determined by experiment. Thus the Degand and Jucunda strawberries were not considered worthy of cultivation until Mr. Knox succeeded in growing them. So also with the Bartlett pear, and Red Astrachan apple, both foreign varieties that succeed well here. Our best cherries come from abroad. A southern fruit brought north is often valuable and the reverse.

The President agreed in the main with Mr. Meehan. It matters not where the variety originates if it is only productive and good.

Mr. Moses Brinton thought there must be something in this theory. While Greenings and Baldwins do not succeed so well in Pennsylvania, they are among the leading varieties in New England and New York.

The next question, "The Preservation of Fruit by Ice or Refrigerator Process," was then taken up.

Mr. Eastburn Reeder gave an interesting description of the fruit preserving house of Mr. Nathan Hellings, near Bristol, Pa. Mr. Hellings' house is about 40 by 50 feet, with thick stone walls, and so arranged that a body of ice some 12 or 14 feet thick is kept over the fruit. The temperature is kept at 32 degrees, and as uniform as possible. There is ample ventilation and an arrangement for carrying off all moisture, which is probably one of the secrets connected with the process. Mr. Hellings claims a patent for his plan of preserving fruit.

Mr. Engle thought this plan might be useful on a smaller scale. Has an ice house with side cellar in which milk and fruit keep very well. Moisture is the chief drawback. These patent processes may include some substance placed inside to absorb the dampness.

Mr. Reeder saw nothing of the kind at Bristol. If the temperature is kept regularly at 32 degrees there will be little or no moisture. Has constructed a milk house, cooled by ice in another room. In winter he keeps fruit in it with good results. Has kept some varieties until August. It is much better than a cellar, but was not built for a fruit house.

The next question, "Should Fruit be Sold by Weight," was not taken up for discussion.

"The Cultivation of the Cherry" was next considered.

Mr. Carter had little experience with the cherry. Thinks "Governor Wood" one of the best. The rearing of the cherry seems uncertain in many places. This may be owing more to the difference in the soil than location.

The President has tried some 30 or 40 varieties. Thinks Governor Wood a good bearer and of excellent quality, but the fruit too much subject to rot

for a profitable market variety. Considered the yellow Spanish the finest of all cherries.

Mr. Engle had but little success with the cherry, especially the Hearts and Bigarreaus. Find the Early Richmond much more reliable. Stated that in York county, cherries grow almost spontaneously. All the varieties, Hearts, Dukes, and Morellos succeed well. The country is hilly and the soil light and porous.

Mr. Sprout has tried many kinds without success. Trees would grow well a few years then the bark on the trunk would burst and the tree die. Has lately been top-grafting on native stocks and hopes to succeed. Have some black knot on sour cherries in his vicinity.

Mr. Carter thinks black knot is disappearing in his vicinity.

Mr. Meehan said there is great improvement in the health in the cherry. The "knot" is a fungoid growth, and can be destroyed by cutting in May or June when green. The success of the cherry depends much upon the kind of stock chosen. Many varieties do well on Mahaleb, but Morello or pie cherries are always more or less dwarfish when worked upon it. Has known trees of E. Richmond on Mazzard stocks that yielded crops worth $30 00. For profit would recommend those grown on Mazzard stocks.

Mr. Engle has had a different experience with the cherry from Mr. Meehan. With him they grow much more vigorously on Mahaleb than on Mazzard stocks.

The President stated that black knot swept the country from the north some 10 or fifteen years ago destroying most of the cherry trees.

Inquiry was made concerning the "Luelling" and "Large Montmorencie," two new varieties of cherries just introduced, but no one present had seen either fruiting.

Mr. Bartram has had much experience only with E. Richmond and English Morello. Has planted 900 trees of the latter variety and finds them very profitable.

Mr. Engle: Although not successful with cherries has fruited some. Early Purple Guigne is one of the very earliest but is generally destroyed by birds. Gov. Wood, Rockport, Bigarreau, and Kirtland's Mary are nearly identical. Black Tartarian is most popular and brings more money than any other. The Russian is also a very popular variety; it is similar in color to Black Tartarian but larger, more fleshy and later. It is the largest black cherry he has ever seen. Does not know where it originated. Has fruited also Osceola and Kirtland's Mammoth, but finds them shy bearers.

In discussing the question of Peach culture, which was next taken up, Mr. Magill stated that in his opinion "Yellows" are the result of severe cold. That trees are often injured in the nursery and before they are set in the orchard. When the mercury falls under 16 degrees below zero, trees

are apt to become diseased, they get black at the heart and can never recover; the only remedy is removal; never knew it to be worth anything afterward. Last winter although quite cold was not severe on fruit trees; the temperature was more regular, not running to sudden extremes of heat and cold. In planting peach trees would cut them back to 3 or 4 feet from the ground. In regard to varieties in this county, we cannot compete with Maryland and Delaware. In isolated cases may, but generally not. Would plant only late varieties for general crop, and a few Mountain Rose for early; would then have Mixon, Late Crawford, Smock and Salway. Had noticed that the yellows in his orchard followed the line of the prevailing winds from North-west to South-east.

Mr. Harvey agreed as to the contagious nature of the "Yellows." Is satisfied it is spread by pollen from one tree coming in contact with another, and also by the roots or in any way by which the disease can be taken into the circulation. In warm countries the disease does not exist and it is not known in forcing houses.

The President thought Mr. Magill had the correct theory, though his own experience in peach culture was rather limited, not extending over about three years. Has some 20 varieties planted. Thinks Salways especially fine Carefully picked and marketed they sold readily in Philadelphia at $1 per half peck, when other varieties brought only 25 cents per basket.

Mr. Harvey did not like to see Susquehanna recommended. His experience with it was not satisfactory.

Mr. Engle would not discard it totally. Has had poor success with it at his own home, but in other localities it does well. Thinks if planted on thin, poor soil it would have a tendency to form fruit instead of wood buds. Has seen it bear equal to any variety, at Winchester, Va. Would recommend Reeve's Favorite. It is a fine yellow peach, of excellent quality, and a much better bearer than Susquehanna.

Mr. Magill has planted chiefly Troths, for early peaches. Would not plant it largely now as it comes in competition with Delaware peaches and is not profitable.

Mr. Engle finds Troth a sure bearer. Mountain Rose ripens about the same time but is a larger and finer peach. Considers the Salway the finest late peach we have of its season. In habit it is similar to Smock, and ripens a few days later. It is more rounding in form than Smock, higher colored and of better flavor

Mr. Bartram called attention to a disease which attacks peach trees, causing them to break in the fork or crotch, many of them breaking apart or falling to pieces.

The new American Seedling DOWNING.

Mr. Engle has heard of the same in reports, but has not came under his personal observation.

Mr. Pannebecker has a variety of peach ripening about the 10th of October. It is a very fine fruit, but he does not find any name or description of it in the fruit books or catalogues.

Mr. Bartram could not recommend Allen's October. Wants no peach later than Smock.

Mr. Brinton asked whether it is advisable to plow a peach orchard that has not been plowed for a few years.

Mr. Engle thought the usual custom in peach growing countries is to cultivate. Has grown fine peaches without cultivation.

Mr. Sprout was through the Delaware peach district some time since. The practice there is to cultivate until eight or ten years old, after which they are put to grass.

The subject of plums was next briefly discussed.

The President asked for information concerning the wild-goose plum.

Mr. Meehan considered the wild-goose of inferior quality, ranking with the persimmon. They are good only when we can get nothing better. It belongs to a class called "Chickasaw," or wild plum, and is hardly superior in quality. They are not curculio proof, but not so liable to rot as the finer kinds They will do for cooking or pies, but few would care to eat them in their natural state.

Mr. Sprout: Speaking of remedies for curculio stated, that from a friend in Michigan, who had visited him, he learned their mode of destroying the pest. It consists in simply jarring the trees with an india rubber mallet, and capturing the insect in a cloth or sheet spread under the trees. This plan has succeeded well. Those who failed to pactice it got no fruit.

A short discussion on quinces was next in order.

The President thought it must be a profitable fruit where successfully grown.

Mr. Engle had planted two hundred quince trees, but they did not succeed.

Mr. Pannebecker had some quince trees four years old which bloomed very freely last spring, but in June found all the leaves dead and branches badly blighted.

Mr. Sprout had similar experience. Lost all his trees by blight.

In reply to several inquiries, Mr. G. B. Thomas stated that he has had no personal experience with the "Wild Goose" plum. Met in Chicago a gentleman from Tennessee who considered it the most valuable plum he has under cultivation. It is a first class fruit for shipping and usually finds ready sale. Mr. Jackson, near Cincinnati, also speaks favorably of it. The question is to get the true variety.

Mr. Meehan: Compared with our finer plums, such as Coe's Golden or Green Gage, the Wild Goose is hardly worthy of cultivation. In size, those he had seen were not larger than Damson plum or a large Fox grape, and in quality similar to the Persimmon.

Mr. Thomas: The Wild Goose plum, to which I refer, is as large as a hulled walnut. Those who can grow Coe's Golden or Green Gage successfully should not plant Wild Goose or Richland. In many localities the finer varieties of plums can not be grown at all.

Before adjournment, a committee consisting of H. M. Engle, A. S. Sheller and S. W. Noble, was appointed to make a selection from the fruits on exhibition, and send the same to Charles Downing.

Society adjourned to seven o'clock.

EVENING SESSION.

The Society was promptly called to order by the President, after which the following was offered by Mr. Meehan and unanimously adopted.

Resolved, That the thanks of the Pennsylvania Fruit Growers' Society are due and are hereby tendered to the "Bucks County Agricultural Society," "Doylestown Farmers' Club" and "Solesbury Farmers' Club" for the excellent hall they have provided for its meeting, and for other arrangements tending to the comfort of its members and the success of its sessions, and to the newspaper press of Doylestown and vicinity for their generous advertisement of the time and place of meeting.

The President stated that he had received from Mr. Stauffer, of Lancaster, a very interesting scientific essay, but that owing to its length and the lateness of the session its reading would be deferred. On motion, it was ordered to be published in full with the reports of the society.

FRUIT TREES.

President and gentlemen of the Pennsylvania Fruit Growers' Association:

As a natural order of plants the rose family or ROSACEÆ is of special interest. While the species of this family, for the most part, inhabit the cooler regions of our globe, and is interesting to the florist for the beauty of its flowers or their perfume, it is doubly interesting to the horticulturist on account of the variety of fruits embraced in the sub-orders of this family. Here we find the apple, pear, plum, cherry, peach, almond, nectarine, apricot, on the one hand, the strawberry, raspberry, blackberry, &c., with numerous varieties of each, on the other. This important assemblage of plants is distinguished by having several (mostly five) petals; separate carpels, distinct perigynous, numerous stamens, alternate leaves and an exogeous mode of growth; but I am not giving lessons in botany, there-

fore need not particularly define them, nor do I design to instruct you in culture and propagation of fruit, as books devoted to these subjects are in your hands, and your experience is ample. But rather treat upon matters connected with the subject, that I may deem interesting or useful to you generally. Fruit culture, like agriculture, dates to earliest ages. The Prophet Joel, enumerating the trees of Syria, says: "The vine is dried up and the fig-tree languisheth; the pomegranate tree, the palm tree also, and the apple tree; even all the trees of the field are withered." Yet it would seem the cultivated apple-tree was scarce at Rome in the time of Pliny, for he states that there were some apple trees in the villages near the city which yielded more profit than a small farm. Pliny also mentions apple trees "that will honor the first grafters forever." When we consider that Pliny, the distinguished Roman writer, was born in the reign of Tiberius A. D. 23, we find "grafting" not to be a new thing. It is evident that the apple tree was held in high esteem by the Romans. The nymph *Pomona*, in mythology, is represented as sitting on a large basketful of fruit, holding a number of apples in her left hand, and in the right a nosegay of flowers, and originally designed to commemorate with divine honors the culture of fruit trees, and especially the apple tree, and for whose favor the cultivators were competitors. A temple and altar were erected at Rome. The officiating priest was called *Flamen Pomonale*, and sacrifices were offered to her for the preservation of the fruit trees of the earth. This to us may seem idolatrous, and yet it is significant how grateful we should be to God for the delicious fruit afforded us.

It is conceded that all sorts of fruit should be gathered from the trees or plants when perfectly dry, and never when in a dewy or wet condition. Many of fine quality, it will be of advantage to, not permit to remain on the trees till they are over-ripened. In gathering them, they should be hand picked; the bloom should always be preserved upon them as much as possible, such as the peach, plum and finer cherries, and deposited in shallow sieves or baskets, spread over with leaves, or some similar material like dried short cut grass; but all this is well understood, if not always practised.

All the parts of the flower are subservient to the formation, impregnation and perfection of the fruit, which is destined to be the source of a new progeny, and mostly formed so as, by various means, to promote its dispersion; all the parts of flowers are but modifications of the leaves—leaves and branches simply developed buds or germs.

The branches are the product of the buds, in which they enjoy, for a certain period, a species of fœtal existence, as the embryo of the trunk did originally in the seed. Thus budding, as a mode of propagation, is particularly useful for peaches, nectarines and apricots, which succeed better

by budding than grafting. Apples and pears may, likewise, be propagated by the budding method, as well as by grafting; but as they grow freely by grafting, which is the most easy and expeditious, that mode is more commonly made use of.

The Abbe Schabol, who gave the subject especial attention, points out some facts not generally known. He distinguished, in fruit trees, five sorts of branches; the first are smooth on the surface, their fibers are straight and closely applied to each other, but easily separated; they are pliant, and break with difficulty; it is upon these branches the *wood buds* are formed. The second sort sustain the fruits—they are wrinkled at their base; their fibers appear to be more interwoven; they are supposed to be endowed with numerous vessels and pores; they contain a thick sap, and when bent are readily broken. The third kind of branches resemble those which become the wood, but are *not* produced from buds; they arise from the bark, and, as they never become hard, they are called the *branches with false wood.* The fourth set are very broad at their base; their bark is brown and rough; their buds are black and not numerous; these branches, like the last, are produced by the bark; they grow rapidly, and soon perish; they are injurious to the tree, in depriving more useful branches of their due proportion of nourishment. The fifth sort are small branches which abound upon unhealthy trees; they exhaust feeble trees, and are useless upon the most vigorous; they die before they acquire any magnitude.

Thus we should be able to distinguish these several branches or the kind of buds from which they are formed, the position and figure or form are peculiar to each and the knowledge useful in nurseries. Bonnet arranged buds into five orders according to their position on the branches: 1st, alternate; 2d, opposite; 3d, surrounding the branch—verticillate; 4th, in a spiral; the 5th vertically over the 1st quincunxes; 5 when arranged in a double spiral. There is also a difference as to the kind of branch they will produce and highly important as a guide in grafting, pruning, &c. The leaf buds compared with the others, are slender, long and pointed; the fruit-buds are thick, short and round; and those of a mixed nature have an intermediate form, being neither so pointed as the one nor so round as the other; usually the flower buds are situated upon the extremity of the little ramifications called fruit branches. In the peach tree and many others of the same family, the wood and fruit buds arise together from the same branch. As I shall have something to say in regard to fungus and animalculæ, in reference to disease in fruit trees as they in connection with the cells and cellular tissue of plants consisting in the organized fabric involved in vegetable growth. Dr. Lindley's definition, "that a plant is a cellular body, possessing vitality, living by absorption through its outer surface, and *secreting starch*," recognizes the essential function of vegetation, starch

being one of its organic products—yet it is only one special form under which nutritive matter created by the plant occurs, and it is not so universal as *cellulose* itself, the matter composing the walls of the cells and vessels of plants. It is insoluble in most menstrua, and is generally characterized by chemical inactivity. When we consider the intimate connection or relation with the mineral world and matters in the soil on which plants feed taken up by absorption from without, and assimilated under the influence of light, warmth and air, as they are chiefly composed of three elements, carbon, hydrogen and oxygen; but these essentials have a wide range of modification, in their atomic arrangement, governed by laws which may be termed chemical combinations. We must trace many diseases in plants to a combination of circumstances operating externally upon them and within their tissues, which produces change as a primary cause of disease, independent of fungi or entozoa.

The yellows in peaches, though not known, I understand in England, has been noticed in the United States since 1800. Many theories are advanced by various observers. In the Agricultural Report in the department at Washington, for 1871, page 119, the result of a series of experiments, with a view to discover the cause of the disease known as the "yellows of the peach," was in the discovery of the development of a copious supply of mycelium in the albuminous matter of the liber; these are figured by Prof. Taylor, in their various stages of growth as found connected with it. The mycelium when matured, is jointed and branched; these are not found in healthy trees; he suspects the germinal matter of fungi, are exhibited by a black dotted appearance, seen when placed under an object glass of two hundred and fifty diameters, he says: "From present observation it would seem that the fungus of the yellows, forms on the last cellular deposit of the cambium on the liber." Remember he says the fungus is not found on *healthy trees*—the question arises, is the fungus the result of the unhealthy condition of the tree? as I think it is, and not the cause of its being unhealthy. Here allow me to refer to the cracking of pears. T. H. Foster, Esq., proprietor of the Babylon nurseries, Long Island, N. Y., sent me nine bundles of pear cuttings, each with a number and remarks upon a label affixed, accompanied by a letter dated January 10, 1876. I will enumerate the labels before commenting upon his views. No. 1, W. D., (White Doyenne, I suppose,) from a tree cracked bad. No. 1, W. D., from a double worked English Jargonelle, has never cracked, is budded near the bottom. No. 1, W. D., Miscellaneous, bore no fruit. No. 2, Madeline, does not crack. No. 3, Flemish Beauty, cracks badly. No. 4, Dutchess, D. A., never cracks. No. 5, Jargonelle, from the same tree. White Doyenne is doubly worked on—never cracks. No. 7, Lawrence, which never cracks. As these statements may prove of interest to others who have given the

subject their attention, I deem it proper to report to this society. In the Agricultural report above referred to, (1871,) is an excellent illustration of a diseased Buerre Langelier pear, attacked by fungi and entozoa, also figured. I shall have occasion to refer to this after noticing Mr. Foster's views, which I shall give, that I may not cover up anything that might prove of value, whether I thought so or not. In a letter to the Hon. F. Watts, Department of Agriculture, dated February 18, 1874, he says: "I find the wood of the Lawrence least infected. Dutchess, Bartlett, Bell Lucrative, very slightly. B. Diel, Flemish Beauty, White Doyenne, most; above observations of the one year old wood; I think a thick rined pear would have more elastic cuticle, think the living principle of fungi on some varieties remain enclosed in the cyst during winter, and opens in spring, when it propagates on the young wood and fruit, while in other varieties the cyst opens the latter part of the same season of its propagation, and becomes harmless; it would be well for you to look for the living spores and ascertain the point." In his letter to me he says: "The reading of an article on the "Potato blight," by Francis Gerry Fairfield, Esq., of New York, published in Vol. XXXII Scientific American, for May 1, 1875, on page 276, has strengthened my theory of minute insects being the primary cause of yellows in the peach as well as the cracking of the pears." He then refers me to the samples sent, and adds, that "trees in sod where animals were enclosed did not crack," and "that washing with lye and potash in early summer, when the leaves come out, did not appear to better the condition of the fruit." Liquid potassa (1lb to 2 gallons of water) did not yield a satisfactory result, as but few sound pears were produced. "I claim," he continues, "that certain varieties are exempt, not because they do not take the disease, but because the fungus ripens and the cyst opens and discharges their spores in the fall."

As regards the article of Mr. Fairfield above stated, I replied to it in a short article published in Vol. XXXIII for July 31, 1875, on page 68. In which I say: "It strikes me that Mr. F. G. Fairfield has things a little mixed up." He carefully cleaned the specimens procured by him, and subjected them to heat for ninety-six hours or more before he examined them. He finds the ova of the insects on the interior layer of the cuticle of the tubers, and says: "I have no doubt that they commence that *histolytic process* that ends in the destruction of the tuber, but I doubt whether there is any *genetic* connection between the fungi developed on the stalks in the course of the *degeneration*, and the larvæ in which the *degeneration primarily starts*." The truth of the matter is that the microscopic animalculæ are a secondary product arising in the diseased matter of the tuber. Certain fungi have a nitrogenous substance analogous to diastase, which transforms the starch to dextrin, and finally into sugar, like a ferment,

especially under moisture and an elevated temperature, inducing decomposition, forming a *nidus* for the production of the animalculæ or their development. Had he used his microscope to trace the parasitic fungus, he would have discovered the fine threads of the mycelium extending to the tubers, (as I found in Mr. Foster's cuttings from trees that cracked bad,) which induces a ferment or gangrenous putrid mass that, like any other vegetable or animal matter will breed or develop animalculæ in less time than ninety-six hours. This is easily proved, and well known to those who have given the subject their attention. Consequently, his sage advice, "to dip the potato just before planting into carbolic acid solution," is, to my mind all nonsense. When the animalculæ or fungi infest the tuber it is neither fit for use or planting." I called Mr. Foster's attention to my reply to the article that confirmed him in his views, and suggested lime to the roots of his plants as more likely to do good than soda washings of the branches.

My neighbor, Mr. Solomon Sprecher, had young pear trees in his garden completely encrusted with the oyster shell scale insect. On the recommendation of some one he mixed a thin paint of oil and white lead, and painted them bole and branches early in spring. The result was a vigorous growth in wood and fresh healthy leaves last summer, and destruction to the scale insect; thus far no injury seems manifest from the application to the trees themselves. I mention this for what it is worth.

Mr. Taylor says, and I tested the matter last summer for my own satisfaction: "By placing a portion of the cellular matter of one of those cracked pears in a piece of muslin and applying pressure, a thick juice passes through the mesh, and a single drop of this, thinned with pure water and put under the microscope, exhibits these animalculæ moving about like snakes through the liquid, greedily eating spores of fungi and cellular matter." These snake-like minute animals are known as *Anguillula*, and arise in soft watery parts of the cracked or diseased pear. Mr. Taylor adds: "I have no theory to advance for the presence of these animal forms in the centre of the fruit." I am aware that corruption is by many thought to be the source of life, or *spontaneous generation*, the vital forces changing direction to develop other forms of life, without pre-existent germs. This theory has been exploded time and again, and again reproduced on the battle-field, and remains a drawn or open question, which will not effect the facts in the case, with which we have to do, whether we believe in *heterogenesis*, that is "putresible bodies," water and air, which might act as a vehicle of organic germs without the intervention of parents, I shall not stop to debate the question. "Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself upon the earth: and it was so," (Gen. chap. I, 11 v.,) and science

cannot make the matter any more clear as to the how; if fungi are excluded from herbs, putrid matter from earth, we may allow some license for want of direct proof to the contrary. Having considered fungi and animalculæ as secondary productions, let us glance at what may prove the primary cause. This opens a wide field and involves many important considerations that can only be glanced at in this article. First, what may impair the vigor and health of the plant?

Here we find groups of volatile matters with varied chemical affinities, metallic and non-metallic and saline elements that enter into the structure of plants, vegetable organic structure. Reproductive organs, running through the entire catalogue, embracing numerous parts, a change in any of which may produce a change in the health of the tree, but there is usually a complication of changes and causes. We can only glance at a few. The air may be vitiated so as to be detrimental to plant growth.

Mr. Angus Smith says, "The air of Manchester, England, will allow no plant to grow—the sulphurous vapor being transformed into sulphuric acid, in excess, which is detrimental to vegetation." The numerous furnaces are the cause. This is a special case, but evidence that the air can be poisoned. It has been shown that the soil may become exhausted. An apple tree will in 60 years remove from the soil 60 pounds of nitrogen, equal to 11,500 pounds of farm yard dung. To keep up the condition of the soil 175 pounds of dung should be applied annually. During 50 years a tree may bear fruit. Nitrogen is one of the chief constituents of the atmosphere, which tempers the oxygen as well as to serve other important purposes. The influence of the atmosphere, as it regards its moisture and dryness, or electric condition, materially effects the health and vigor of plants. Cold and easterly winds of spring, which nip and destroy the tender shoots, by stopping the current of the juices; depriving the leaves of their due nourishment, causes them to wither and fall; and the juices that are now stopped in the passage, swell and burst the vessels, forming a viscid nidus for breeding animalculæ or fungi, these contribute to the extension of the evil. Early frosts in spring, after prematurely mild weather starting the sap and swelling of the buds or expansion of the flower. Subsequent frosts will result in like manner. Even in summer blight is noticed when there are no cold winds nor frosts to account for it, and known to occur after short but heavy showers, occurring about noon, followed by clear sunshine. This has happened to grapes about the season of their ripening, in which the middle of the vineyard suffered the most, known to some as the *fire blast*. I had a peach tree in my yard with fruit nearly of full size, blasted as if by lightning, the fruit died and kept hanging during the entire winter. Many who saw it expressed astonishment, as a thing they had never seen before. I had it cut down last fall, as a

hopeless case. When the atmosphere is surcharged with moisture, long continued rains, or excess of water to the roots of plants, an excess of their juices occurs, similar to dropsy. That is, their absorbing actions become too great for their exhaling.

This Willdenow describes as occasioning a preternatural swelling of particular parts, and inducing putrifaction—just the thing that induces the growth of fungi and animalculae.

So the exudation of gum may insinuate itself into the other vessels of the plant, and occasion obstructions. And when the sap ascends more copiously than it can be carried off, it sometimes occasions a fissure of the solid parts, inducing disease or deformity by encouraging the extravasation and corruption of the ascending or descending juices. As when occasioned by frost, forming what is called a double alburnum ; that is, first, a layer that has been injured by the frost, and then a layer that passes into wood, sometimes a layer is partially effected, owing to a sudden and partial thaw on the south side of the trunk, which may be followed again by a sudden frost. In this case the alburnum is split into clefts or chinks, by the expansive force of the freezing of sap. These clefts may generate into a chilblain, forming knots, etc., as before stated. Thus, as a botanist, it is simply glancing at other causes than insect depredation. As an entomologist I could enumerate a host of evils to vegetation, occasioned by insects; but the evils are, alas! to well known to fruit growers—but my verdict is, that only so far as insects are instrumental to deplete and cause exudations to weaken the vitality of plants are they chargable, as a primary cause, but this has no reference to animalcula or fungi as chargable of all the evil, of which they are promoters to hasten decay, and in some cases prove primary as parasites.

Nature is very prolific in resources, to overcome its opponents in the contests for life, provided the proper nourishment and attention is given to it, to enable it to keep up its health and vigor. A more thorough acquaintance with the laws of health, growth and proper management would greatly aid the horticulturalist.

I know much is put forth from experience, and very much that is simply speculative. I claim only to be suggestive to call attention to side issues, too often overlooked or not presented to the general reader. There are certain forces in nature which the most learned cannot fathom, their lines even of matter-of-fact inductions, on the physical plane, are too short to reach the solution of underlying or hidden forces.

There is a serious disease in plants, called by Thiery, "la dissolution," this seems to be a sudden decay of the vital principle, like that produced

in animals by lightning. This disease is mentioned in reference to the Nopal of Mexico, one minute its surface is verdant and shining, the next it turns yellow, and all its brilliancy is gone. On cutting into its substance the inside is found to have lost all cohesion, being quite rotten. The only remedy is speedy amputation below the diseased part; sometimes the vital powers of the plant throws off the infected joint or branch to overcome the effects of this mortification; this is stated by Rhind, p. 132. Without further comment, the foregoing is respectfully submitted to the consideration of those interested in this subject.

By yours,

JACOB STAUFFER,
Botanist, Society.

Lancaster City, Pa.

The committee appointed to report upon the fruits on exhibition, submitted the following, which was accepted and committee discharged:

The committee to examine the fruits on exhibition, respectfully report that there was a considerable number of apples and 3 varieties of pears exhibited, as follows:

A. H. Barber, 2 varieties of apples.
D. W. M'Nair, 3 varieties of apples.
Casper Hiller & Son, 4 varieties of apples and 1 of pear.
H. M. Engle, Guntner's seedling apple and Easter Beurre.
Calvin Cooper, 3 seedling apples and Easter Beurre.
W. P. Magill, 2 seedling apples and Easter Beurre and Vicar of Winkfield pears.
Alf. S. Sheller, 4 seedling apples and Easter Beurre.
J. W. & H. S. Paxson, 10 seedling apples and Easter Beurre.
John Eastburn, 1 basket Smith's cider apples.
A. R. Sprout, 6 varieties of apples.
Robert Ivens, 2 varieties of apples.
John I. Carter, 12 varieties of apples.
W. H. Stuckard, 1 variety of pear, good quality, name unknown.

The apples were mostly of well-known varieties, Smith's cider appearing to be the leading kind. There were several seedling apples exhibited, among which, "Gunter's seedling" and "Ritter" apple, from Lancaster county, were favorably thought of.

"Bowden" apple, from N. H. Burroughs, near Doylestown, a fine looking, striped apple, appears to be a good keeper of fair quality.

The "Major," exhibited by Alf. S. Sheller, of Union county, still seems to merit the favorable notice given at our last meeting.

A handsome seedling apple, called "Tremont pippin," originating with Mr. Jas. Armitage, and exhibited by H. S. Paxson, the committee think deserving of further trial.

(Signed.)

SAML. W. NOBLE.
JOHN I. CARTER.

JANUARY 20, 1876.

The society continued its discussions by taking up the subject of Strawberry culture.

Mr. Carter has not been very successful with strawberries. Has had some 12 or 15 varieties; considers Chas. Downing the best; Kentucky and Seth Boyden have also done well; Lady Finger did well last season but not so well this year. Inquired what success others had met with in early fall planting. Had tried it and lost nearly all his plants.

Mr. Engle has had experience in fall planting. Early planting only successful.

Mr Sprout commenced raising strawberries about 15 years ago, and is beginning to feel at home in the business; of late has been quite successful. Of varieties prefers Wilson's Albany and Degand mixed. Has been successful both in fall and spring planting. Generally covers his plants in the fall.

Mr. Pannebaker: The Chas. Downing does not succeed with us.

Mr Thomas considered Chas. Downing the best for his locality, though not quite so productive as Wilson's Albany.

Mr. Meehan: Fall planting in light sandy soils will do well, but where soil is wet the plants generally freeze out. Many injure their plants by covering too deeply. Would cover lightly to protect from the sun. By laying the runners in small pots early in the fall they become well established and can be transplanted at any time. If not planted too late in the fall they will bring a full crop the following season.

Mr. Bartram never had much experience with strawberries. Wilson's and Cutters' seedlings do best with him. Has tried Agriculturist three or four times without success. Prefers spring planting.

Mr. Engle would not recommend general fall planting, unless under very favorable circumstances. Good plants are the first requisite and if planted in August with favorable weather and proper care, a good crop may be had the following season.

The President thinks fall planting has discouraged more than anything else. Plants early in spring. No crop is more certain than the strawberry. Has grown them over twenty years and has never failed to have an excellent crop. In regard to covering did not agree with Mr. Meehan; experience has taught him that thick covering is the best. t keeps down

weeds and keeps the fruit clean. He plants in rows 2½ feet apart and works with cultivator all summer, allowing all the runners to take root on the rows that can do so.

Mr. Sprout has had best results by cultivating in rows and keeping down all runners in fruiting season. Related his experience with one-eighth of an acre of strawberries from which he mowed the tops close to the ground immediately after fruiting. The result was a crop of one thousand quarts of berries, which sold readily at twenty cents per quart. Since then is in the habit of cutting off the tops.

Mr. Pannebaker stated that he has also cut off the tops of his plants with favorable results.

The President: Our leading variety is Jucunda, out of five acres three are Jucunda. Soil, a light micaceous sandstone made very rich by manuring. Has about a dozen other varieties, including Wilson's Albany, Boyden's No. 30, Kentucky, Green Prolific and Monarch of the West. Plant Kentucky on account of its lateness. Monarch of the West is larger than Jucunda but not so good color. Boyden's No, 30 is a fine market berry, bearing shipping very well. Have discarded De Gaud, it not being productive.

M. V. Sprout: De Gaud with me does very well on heavy clayey soil but not on sand. Does better than Albany on clay soil.

RASPBERRIES AND BLACKBERRIES.

Mr. Carter: Have had but little experience with raspberries.

Mr. Engle: Have grown Black Caps most successfully. Have also raised fine crops of Philadelphia.

Mr. Meehan: In traveling through New Jersey during the past two or three years, has noticed a general failure in blackberries in many sections, ofttimes dwindling away by the acre. The blackberry is one of our hardiest fruits, and the cause of their frequent failure is well worthy our consideration. The manner of culture is probably the cause. The practice of close trimming or pruning, to avoid staking up is probably a cause of failure.

Mr. Engle thought the failure in blackberries in his section was owing to the grub.

The President: Probably one reason New Jersey plantations have gone down is that they did not pay. Has plantations of raspberries that do just as well as they did a dozen years ago, showing no signs of failure. Herstine does splendidly and is most valuable for general purpose. Is not so suitable for shipping great distances. No one having a garden should be without it. Thinks it even more hardy than Philadelphia. Saunders is similar to Herstine but not quite so strong a grower. Cultivates a few

Black Caps, because earlier. They never command near the price of the red varieties.

Mr. Engle: In some sections of New York, Black Caps seem to lead off.

Mr. Bartram: Brandywine brings almost double the price of other kinds.

CURRANTS AND GOOSEBERRIES.

Mr. Carter: Of the new gooseberries find, Smith improved promising well.

The President: Downing is larger and finer.

Mr. Meehan mentioned a suggestion made to him some time ago by a German, in reference to gooseberry culture. The chief drawback in its culture, especially the English varieties, is mildew. This, he claimed, was caused by the ground becoming overheated; this he would prevent by mulching heavily with corn stalks, small stones, &c. We might grow some of the foreign kinds by grafting on hardy roots; so also with currants. These suggestions were made to him (Meehan) only a short time ago, and he gives them for what they are worth.

The President thinks the idea not practicable, because those plants always renew from the roots. It is known by all fruit growers that Houghton or Cluster bear every year without care or attention.

Mr. Lint: Currants and gooseberries should be trimmed every year or they will become too thick and bushy, would cut away half the wood every year. Gets finer fruit and of better quality.

Mr. Engle does not think Houghton and Cluster identical. Cluster bears more profusely but is not quite so large.

The President considers the gooseberry one of the most profitable crops. Has from two to three hundred bushels every year which cost but little more than the picking.

Mr. Meehan inquired whether there is any better variety of currant than the Red Dutch. Has Cherry and La Versailles larger berries and perhaps better, but do not bear as well. As far as his experience goes has no more profitable variety than Red Dutch.

The President considers Cherry more profitable than Red Dutch. Perhaps it requires more care.

GRAPES.

Mr. Carter: Have but few varieties that are worth cultivating. Have been much pleased with Telegraph. It is earlier than Concord, showy and sells well. Concord is our main crop. Have not fruited Walter nor Elsinburg, nor even Martha to any extent.

Mr. Hiller: Ives Seedling does very well in our vicinity, which is about eight miles south of Lancaster.

Mr Engle spoke favorably of Ives Seedling. It is earlier than Concord but will hang longer on the vines. In foliage it resembles Hartford. Quality, none of the best, but fully equal to Telegraph. Rogers' Hybrids are not so hardy as Concord and Ives, but they bear occasionally fine crops of fruit of good quality. No. 3 is one of the best in quality, but a weak grower. Nos. 4 and 19 are among the leading kinds. Of Arnold's Hybrids none amount to anything except Cornucopia. Eumelan is not satisfactory, being subject to mildew. Walter seems weak in foliage. Quality and appearance similar to Catawba.

Mr. Thomas: Have found only 3 or 4 kinds of grapes of general value. Concord, Martha, Ives, and Telegraph are the leading varieties. Have never thoroughly tested Walter. As a market grape in the vicinity of Boston, Ives Seedling seems now to be taking the place of Concord.

Mr. Meehan stated that all the finer kinds of grapes can be grown by grafting on the roots of Concord or Clinton or other strong growers. Has seen Allen's Hybrid and Rebecca grow as strong as Concord by this method. He briefly explained the process of grafting.

Mr. Engle in reply to an inquiry as to the best and most economical way of training the grapes, stated that there are different methods in vogue in different sections, each having merit. Had himself practiced what is known as Fuller's plan, and considered it one of the best.

BEST EVERGREENS AND DECIDUOUS SHADE AND ORNAMENTAL TREES.

Mr. Meehan: Much depends on the location and purpose for which they are planted. When exposed to high winds Pines are best, the White, Austrian and Scotch being the leading varieties. Where close trimming is required Scotch pine is probably preferable. Of the spruces Norway and Hemlock are most popular, but not so suitable for exposed locations. Balsam and Silver firs are still more sensitive to winds, and are slower growers than either the Spruces or Pines.

Where rapid growth is the chief object the California pine is recommended though in some of the eastern States it is subject to a fungus which destroys the foliage. Among the rarer firs Nordman's is one of the finest and very hardy. The new Japan spruces are equal to any in beauty and hardiness, and are probably free from fungus.

Mr. Thomas would add the Retinsporas from Japan, which are perhaps the most promising of new evergreens. They are entirely hardy having withstood the extremely cold winters of '72 and '73, when so many evergreens were injured. For small yards would recommend the smaller arbor vitæs. Box are also hardy and desirable.

Mr. Cooper: What is the best season for trimming pine?

Mr. Meehan : Spring is preferable.

W. P. Brinton inquired of Mr. Thomas what varieties of Retinspora he would recommend

Mr. Thomas named " Obtusa nana," " Plumoso" and " Plumosa aurea." The Retinesporas resemble Arbor Vitæ and some varieties of the latter are frequently sold for them. They grow to various heights, from ten to thirty feet.

ROSES AND SHRUBBERY — BEST AND MOST DESIRABLE VARIETIES.

Owing to the lateness of the hour, these subjects were also very briefly considered.

Mr. Meehan thought there would be some difficulty in anwering this question, owing to the difference in tastes and various purposes for which roses and shrubbery are planted. Of shrubs for the yard or lawn, thinks there is nothing better than Weigela Rosea, and if he were confined to one variety, would probably select this. The Spireas are also desirable, " Reveesii," being best for spring blooming, while " S. Douglasii," and " S. Billardii," bloom almost continually until frost. Lilacs too, are always desirable. Of these the Siberian is one of the most beautiful, coming into flower when all other lilacs are gone. Another fine and very early blooming shrub is the Pyrus Japonica. Of summer flowering shrubs there is rather a dearth. After Deuatzi must fall back upon Althea for flowers In. Magnolias there is nothing very new and some varieties make rather large trees. As to roses he is considered orthodox. Is partial to the old " Damask," and would plant largely of these old fashioned roses. Some of the tender roses are fine bloomers and of exquisite fragrance and are worthy of every attention. The China roses are free bloomers, but not so fragrant.

Mr. W. P. Brinton hoped that others of our leading roses would be named and recommended. Safrano, Malmaison, Madam Margottin are among the most constant bloomers.

Mr. Meehan stated that in England a committee of twenty-four judges was appointed, each of whom should name twenty-five roses in the order of their preference, and of the twenty-four, sixteen chose as first choice " Louis Van Houtte," a hybrid perpetual.

Mr. Thomas named as among the leading hybrid perpetuals, " Gen. Jacquiminot," "Gen. Washington," and " Madam Charles Wood." " Giant of Battles," is also a fine rose but a poor grower and liable to mildew.

The president thinks nothing can exceed the " Safrano" for beauty.

Mr. Thomas : It is not equal to " Marshal Neil" for beauty of bud.

Mr. Sheller read the following resolution which was adopted by this society at its last meeting:

"*Resolved*, That it is the sense of this society, that our Legislature should pass a general law prohibiting the running at large of cattle, horses, sheep and swine."

He moved its re-adoption at this meeting.

Mr. Sprout: This is a subject on which I feel at home. The question was recently brought up at our local Farmers' club, and I was made chairman of a committee to consider the matter. We have sent petitions to the Legislature from time to time. We could probably have a special law, but we want a general law.

Mr. Meehan: By the terms of the new Constitution the Legislature can pass no special laws. Must pass general laws.

Mr. Thomas: We have such laws in Delaware and Chester counties, but they are not generally enforced.

The resolution was unanimously adopted.

Mr. Sheller stated that Mr. Purman, member of Congress from Florida, was present, and hoped he would address the society before adjournment.

Mr. Purman thought it rather late to make any remarks, but would be brief. Stated that orange culture was one of the leading industries in Florida, and that as a business it was both pleasant and profitable An orange grove of five acres will, at the age of 12 to 15 years, produce 15 to 18,000 oranges annually. Trees live to the age of 500 years, and are not subject to disease. Land is both plenty and cheap.

The climate of Florida is its chief attraction. There is no winter. The average temperature is about 78 degrees. Is a native of Pennsylvania, went there as a soldier and intends staying, would advise young men instead of "going west" to go to Florida. By engaging in orange culture in 10 or 15 years you may be "healthy, wealthy and wise." The Florida oranges are larger and finer than those from the Mediterranean. It is estimated that the United States import 10,000,000 of oranges annually, and there is no danger of a surplus for years. In 1835 all the trees were killed by frost, and northern men confine their plantings to the sourthern portions of the State. When once established, an orange grove will yield a handsome income annually. Knew of a grove of five acres, some 75 miles south of Jacksonville, for which the proprietor was offered $100,000. He concluded by thanking the society for their kindness and attention, and invited all to pay him a visit in Florida.

UNFINISHED BUSINESS.

The subject of a State display of fruits being made at the Centennial by this society was again resumed.

It was suggested that the Centennial committee appointed at last meeting be discharged, and a new committee of five be appointed to confer with Mr. Burnet Landreth in reference to said display.

The suggestions were embodied in the following resolution, which was offered by Mr. W. P. Brinton:

Resolved, That a committee of (5) five be appointed by the chair to confer with Mr. Burnet Landreth, and tender the services of this society in having a full exhibition of the fruits of this State on exhibition at our coming Centennial.

Mr. Engle favored the resolution, but thought the committee as suggested too small. Moved to amend by making the committee consist of 10, which was agreed to.

Mr. Carter thought the committee should have the full and explicit authority of the society to act for them, and offered the following additional amendment, which was adopted:

Resolved, That we hereby give the committee power to act for the society at their discretion.

The original resolution as amended was then adopted, and the following committee appointed by the chair:

W. P. Brinton, John I. Carter, A. R. Sprout, H. M. Engle, Thomas Harvey, A. S. Sheller, Wm. M. Pannebaker, Calvin Cooper, H. T. Darlington, E. B. Engle.

Whereupon the society adjourned.

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